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A UNIFIED COMMAND AND DEMOCRACY IN AGRICULTURE¹

By President JAMES D. HOSKINS

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No question to-day, I dare say, is more subject to debate than the problem of a unified command. Yet it is scarcely a matter of debate. Military experts, statesmen, laymen in high quarters and an aroused public are demanding a unified command! For the United Nations at large, for the armed services of each, and for the wayward committees, commissions, bureaus and departments throughout our decentral-ized democracies—the immediate postulate of hope for victory in this war is a unified command. It is more of a battle cry than an argument.

While we confess to the need for such a command

¹ Address by the President of the Association of Land-Grant Colleges and Universities at the fifty-seventh annual meeting in Chicago, October 28, 1942.

in war, let us not forget for a moment what we are about. The perils of the cure are but little short of those of the disease itself. We are but fighting fire with fire. For the ultimate potentiality of the unified command is the totalitarian state. Our security lies in our recognition of both the strength and the weak-ness of democracy. It lies in our ability to put aside our inherent weakness of individualism and prolonged debate in order to assume the full power of our strength in unity of purpose under a unified com-mand. That we are slow to do so is but evidence of our whole-hearted commitment to decentralization of authority and to local autonomy. Our departure from these basic tenets of democracy is but temporary and for the sole purpose of winning a war. Otherwise,

the democracy we have known is gone from us forever, and the post-war world will be foreign to our conceptions.

THE POST-WAR WORLD

I would speak to you to-day of the post-war world and the place of the land-grant college in that world. There are those who would decry this theme. There are those who contend our whole thought and energy must be devoted to the present moment—to winning the war, that is—and the post-war world can wait the event of victory. But how can this position be maintained? How can we motivate the effort necessary to achieve victory except as we are permitted to visualize the fruits of victory? Can any worth-while end whatever be achieved—except a jack-pot or a dice game gamble—without a clear conception of the end sought? The scientist, the scholar, the world's workers are not gamblers. Nor can the present world carnage be conceived as a crusade for democracy save as the post-war world is clearly perceived as democracy.

It is the clear responsibility of some one—and, I think, of the colleges and universities—so to shape this post-war dream that it shall be worth fighting for. Indeed, I shall go so far as to say that the present war can not be won—as it is not worth fighting—unless all of us have a better world in mind to motivate our arms. Thus, if you please, in addressing myself to the problem of a unified command and of democracy in agriculture, I have in mind primarily the preservation and certainly the restoration of democracy in agriculture in the relationships of the land-grant college, but I am convinced, too, that in our discussion we are planning for victory itself as well as for the fruits of victory to be enjoyed at some later time.

THE LAND-GRANT BACKGROUND

Last year I reported to the executive committee of this organization upon a most significant problem confronting the land-grant colleges. I must review it briefly to lay the foundation for such action as the association may deem necessary.

It is significant, to begin with, that the U. S. Department of Agriculture was established by act of Congress in 1862, the very same Congress enacting also the Morrill Act for the endowment, support and maintenance of the land-grant colleges. An identical philosophy of aid to agriculture inspired both acts and founded a national policy of cooperation between these two agencies which has been maintained down the years. What is even more important, the Congress laid down a pattern of cooperation between the Federal Government and the several states, marked by democratic procedures in agricultural education and research and the formulation and development of programs for farm people. The Congress also

defined the contribution each agency should make to the development of the nation's agriculture in mutual cooperation.

With legislative assent to the Morrill Acts of July 2, 1862, and of July 23, 1866, the several states accepted the educational and research responsibilities of this cooperative relationship. The national pattern therefore became more or less uniform between the several states and the Federal Government for the development of agricultural aid programs in the democratic way—namely, the Federal Government functioning in the several states through the land-grant colleges or in close cooperation. Congress further developed this pattern by the Hatch-Adams Act of 1887, providing state agricultural experiment stations, and the Smith-Lever Act of 1914 for extension in agriculture and home economics. A subsequent Memorandum of Understanding between the colleges of agriculture and the U. S. Department of Agriculture developed the policy still further. And so for seventy years all went well.

In their cooperative relationships the two agencies have made use of the research of the scientists of the respective experiment stations; the research work of the scientists of the U. S. Department of Agriculture; the practical demonstration experience of the extension agent; the knowledge of the resident faculty of the college; and in brief the facts and information from all state and federal agencies that could make a contribution in the formulation and development of the program. Of even more importance, they have utilized the active help and guidance of farmers and farm women whom the program is designed to help. This is democracy in the development and administration of agricultural programs. This has made it possible to adapt agricultural programs to local types of farming areas.

THE ALTERED TREND

And now please note briefly the changing philosophy in the U. S. Department of Agriculture at Washington, the disruption of the established policies and the beginnings of a unified command which threatens the democratic foundations of this cooperative work.

Until 1933 almost all Federal funds for development and aid to agriculture were as grants in aid to the states and were administered by—or programs were developed in close cooperation with—the land-grant colleges. At the present time these grants in aid are very small in contrast with monies expended by recently established agencies of the U. S. Department of Agriculture which deal directly with the farmers and not through the colleges. In substance these agencies pay the farmers for putting into effect better farming methods, whereas the Agricultural Extension Service can only recommend these pro-

grams. In 1940 three of these agencies spent for personnel alone approximately \$123,000,000 in contrast with \$18,500,000 allotted to Agricultural Extension Services in the 48 states and two territories.

Consider, please, the confusion which results when: The AAA is requesting farmers to execute a farm plan to participate in payments for Soil Conservation practices. The Farm Security Administration requests clients to execute a farm plan to be eligible for loans and grants-in-aid. The Soil Conservation Service is requesting farmers to execute a farm plan on farms included in Soil Conservation districts. The Agricultural Extension Service of the college is, also, aiding farmers in planning their farms in the most efficient manner. Here are four agencies operating in the same county, and on the same farm in many instances, each endeavoring to help the farmer plan his farm.

Inevitably there is the tendency to centralize in each of these agencies all the phases of the agricultural program, educational and research functions along with the fiscal and regulatory. And there is the further inevitable result of centralizing the control of all these agencies in the Department of Agriculture at Washington. Here, then, is the unified command of aid to agriculture which threatens to shatter the whole democratic base. Instead of farm programs developed in the local communities by the farmers themselves—with aid delegated to the several states through the established cooperative relationship of the land-grant college and the U. S. Department of Agriculture—there is the field personnel of Federal agents responsible not to the citizens of county or state but directly to Washington.

It is not my duty to fix responsibility nor to cast stones at any one for this drift of affairs. There has everywhere—and not in agriculture alone—been a drift toward centralization of power in the Federal Government. Federal subsidy has cast its tentacles around the states in education and transportation, to mention only two other public services. We seldom hear, these days, as we probably should, of the struggle for "states rights." But there are two very definite factors to be considered in agriculture's waning democracy of procedure and the waxing of a unified command. One of them is the subsidy itself. Washington can, unfortunately, buy its way into complete control unless our democratic conscience and consciousness awake to the peril of the subsidy—frequently conscience money and always from the citizens' own purse. The second factor has been the failure of the land-grant colleges themselves to accept and administer uniformly the programs enacted by Congress, notably the first AAA act of 1933. The Secretary of Agriculture called upon the Agricultural Extension Services of the several states to put the

educational phases of this program into operation under the cooperative terms of the original (1862) relationship. Most states assumed this responsibility, but some did not, apparently interpreting differently their responsibilities under the Morrill Act and the 1914 Memorandum of Agreement. And indeed, the Department of Agriculture had to negotiate a different working agreement with each of the land-grant colleges. Inevitably this factor alone would have driven responsible federal officials to think in terms of a unified command.

THE DEMOCRATIC BASE

I should like to point out how contrary to democratic principles a unified command of this sort over this segment of our national forces would be. Aside from the individualistic nature of farmers, who merely might not "like" a strongly centralized authority over their destinies, farming itself does not lend itself to either long-distance or general planning. Farming is local and particular—to such an extent, for example, that no general textbook in agriculture is ever satisfactorily applicable to most sections of the country. Weather and topography combine with human nature to make America inevitably democratic. Unless we blindly permit the short-sighted among us to thrust our heads and hands and feet in the stocks of totalitarianism, we must be free and democratic by virtue of the difference between and among us. A plan for one farm in our state of Tennessee, for example, is difficult enough, for on one side the farm is likely to be lush meadow and marsh while on the other it rises to limestone hills or flinty mountain tops. I am quite sure that only Tennesseans can plan for Tennessee, and for my part I beg to be excused from enforcing plans upon Illinois, Texas or Maine. Who but the land-grant college has employed the agronomists and soil specialists and engaged in hundreds of research projects to determine what any given state affords and needs? What agency but the same college is perennially engaged with the shifting scene, in season and out? I can not conceive of a federal bureau, however well intentioned, achieving the decentralization of knowledge and effort necessary to succor and relieve the farmers of America, now benefiting from day to day by the localized effort of the land-grant college.

I concluded my report to the executive session last year with these words:

There should be just one educational source in the state to which all farm people should look for information in agriculture and home economics, in connection with agricultural programs, and logically this is the land-grant college. There should be just one agency contacting the farm family to aid it in developing farm plans best suited to its needs, and the logical agency to assist farmers in

making such plans is the Agricultural Extension Service. All other agencies of the U. S. Department of Agriculture should be so coordinated around this educational service as to help the farmer develop the farm plan best suited to him. The college can assume these educational functions without becoming enmeshed in fiscal and regulatory activities. The foregoing coordinated relationship between these agencies will make it possible for the land-grant colleges to contribute most effectively to these programs, preserve their democratic administration, prevent a growing duplication and overlapping of services, achieve the most economical and efficient administration and eliminate the misunderstanding and confusion in the minds of farmers.

RECENT EVENTS

Events of world-wide significance have taken place since the last meeting of this association, almost a year ago. At that time, we were preparing to defend ourselves and our democratic institutions from the power and ruthless philosophies of foreign, totalitarian nations. To-day we are actively at war, and challenging, with our allied nations, the power and philosophies of these nations. We are determined to stop and crush their onward, destructive, looting march throughout the entire world.

The United States is at the crossroads and in the gravest crisis of her history. Freedom of the people, democratic institutions and a whole way of life are in peril. There is no turning back from the task we have undertaken. We must not only fight to preserve our national ideals, but we must guarantee to the oppressed peoples of the world the same right to life, liberty and the pursuit of happiness that we claim for ourselves.

At this annual meeting, therefore, the association may well consider, in the various sessions, the contribution the land-grant colleges can make toward winning this war, and toward the perpetuation of the ideals of liberty and democracy inherent in the government of the United States. The programs of the various sessions have been arranged for consideration and discussion of the adjustments necessary to this end.

For my part, I would conclude my recommendation concerning a unified command. It is generally recognized that the exigencies of war require centralization of administration of certain powers and war programs to a degree unprecedented in peace. This is necessary for the complete mobilization of all the material and human resources essential to winning the war. That is certainly true in this war, the most gigantic struggle in which the United States has been engaged. The welfare and security of all the citizens are more important than the personal liberty, independence and rights of individual citizens. Drastic situations require measures to meet them. I think all the land-grant colleges concur in this philosophy.

There is necessary a Selective Service system to select and train the manpower of the United States for the great task of protecting our liberty and independence. It is logical that there be a War Production Board to see that these men get the tools and instruments of war in great quantities. It is our duty to see that the supply line operates from the home front to the fighting front in an uninterrupted flow. There is necessary an Office of Price Administration to control the cost of living and to distribute as uniformly as possible to the citizens of the United States, according to need, the necessities of life that are available to the civilian population.

Similarly there is need of an Office of Defense Transportation to conserve the transportation facilities for war needs. Also, an Office of Civilian Defense for air-raid protection, fire control and other services; also an Employment Service and Man Power Commission to direct effectively our labor where it may be most effective in the war effort, and many other agencies for the effective waging of war.

For the duration of the war, also, there may be necessary greater centralization in food production programs for lend lease, armed service and civilian demands. The important thing is to see that the food is produced to meet these requirements—and before this war is over rather drastic measures may have to be resorted to in labor placement or more specific designation of essential food and fiber crops consistent with the labor available.

All these war measures exercise controls of one kind and another on the civilian population and guide and direct the action of each individual citizen in the war effort. They limit or subordinate his independent action for the sake of a greater good to the citizens as a whole and their security, freedom and independence. Just how severe these controls may become depends on what it may take to win the war. Logically all such programs must be highly centralized in various departments of the government, and the Chief Executive must be given broad wartime powers in an emergency. It is here we enter into the twilight zone between democracy and totalitarian government, where the unified command is necessary as a temporary measure but if adhered to permanently is the end of democratic procedure.

Thus it is, that despite the fact that our greatest task at the present time is to adjust our resident instruction, research and extension activities toward winning this war, we must look forward into the future, into the post-war world. And we must see to it that these controls are released as rapidly as the public welfare warrants and that our democratic institutions and procedures in planning and developing educational and research programs are in accordance with the pattern laid down by the Congress of 1862

in the acts creating the U. S. Department of Agriculture and the land-grant college. This, then, is the specific recommendation that I bring before this body—the restoration of the democratic relationship between the U. S. Department of Agriculture and the land-grant colleges and other departments and agencies of the Federal Government all along the line—as swiftly as possible in the post-war world.

FURTHER RECOMMENDATIONS

We should be looking ahead, also, to broadening the pattern of cooperation to include engineering research in the College of Engineering and also research in home economics. The Morrill Act, in addition to specifying the teaching of agriculture, also provides that mechanic arts shall be taught. The teaching of mechanic arts is just as dependent on research as agricultural teaching is, and research in this field is just as much a governmental function. It has always seemed to me that resident instruction in the mechanic arts should be supplemented with research in the same way the Hatch-Adams Act of 1887 supplements resident instruction in agriculture with research.

A study of the Morrill Act and the statements of Justin Morrill indicate that it was his intention as well as his associates' in Congress that equal opportunity and facilities in the field of agriculture and engineering should be available. This will not be the case until the same amount of federal funds are available for engineering research as are available for agriculture. We should work toward this end.

The demand for engineers at this time in war industries and in the armed services emphasizes the importance of this expansion at the present time. We are living in what has been called a technological machine age, and the war in which we are engaged is a highly mechanized war. Such conditions call for more highly trained engineers and indicate the need for increased research in this field.

Nutrition for human beings is a rapidly developing science. For many years we have been studying the nutritional habits of live stock, and at last I am glad to say we are getting around to the serious study of

nutrition for our citizens. Certainly this should be one of our most important sciences since it is so vitally concerned with human welfare. There is much to be explored in this field. If we are concerned about money for research in agriculture and in engineering, we should be equally concerned about funds for research in this field of human welfare which we know as home economics.

The Agricultural Extension Service is carrying a very heavy load. This, of course, is the division of the college through which education in connection with all war programs is carried to the public—for scrap metal and salvage, for war bond and stamp sales, for essential food and fiber production goals, for price control and so on. A special committee has gone before the Bureau of the Budget to appeal for emergency funds for increased personnel to carry on these expanding programs. What this committee has accomplished remains to be seen. In any event, if the Agricultural Extension Service is to assume these increased war duties, increased Federal funds should be available.

There is no body of men and women anywhere in this country who are working with greater unity of purpose to win this war than the teaching, research and extension staffs of the land-grant colleges. They bring to our young men and women the right appreciation of the obligations which they have to our national life, and upon this appreciation the perpetuation of our democracy depends. In the democratic policy or pattern provided for in the Land-Grant College Act, and the act creating the U. S. Department of Agriculture, and the cooperative relationship between them during the past eighty years, the land-grant colleges have made a great contribution to the development of the nation's agriculture and industry. Their usefulness has continually increased. This relationship sets a pattern for all educational programs sponsored jointly by the Federal Government and the states. This relationship is essentially the democratic process in the development of educational programs for the masses of the people and is the basis of an enduring democracy and of democratic institutions.

THE FULLER UTILIZATION OF SCIENTIFIC RESOURCES FOR TOTAL WAR¹

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To the scientific worker it is a matter of the gravest concern that the scientific resources of the nation are

still far short of full mobilization for war. Scientists are involved in this war as are all people: their deepest interests as citizens, in common with all others, are threatened to their foundations. But they have a spe-

¹ Presented at a meeting of the New York Branch, American Association of Scientific Workers, New York, October 7, 1942.

cial interest in the war beyond the ordinary. Science has perfected the weapons of war, trained its immediate personnel and provided the means both for defense against it and for the repair of its ravages. Science operates in this war on the fighting front, in the factory, in the laboratory and also in the mind of the scientist. The skilful use of the weapons of war; the efficient production of the best weapons; the development of still better weapons; and the discovery of principles and techniques that underlie still further development—all these aspects of science are indispensable for total war. Weapons are not alone guns, tanks and planes. They are also ships, trucks, roads and bridges; they are food, clothing and shelter; they are vaccines and sulfonamide drugs; and—by no means least important—they are ideas. Total war demands all our resources for its successful prosecution. We are not yet waging total war; nor are we yet winning significant victories. Lack of full utilization of scientific resources is one phase only of a more general deficiency. It is an important phase, and one to which we, as scientific workers, can and must address ourselves with particular attention.

Total war demands the utmost efficiency in leadership from above, and alike in cooperation from below. Neither the leadership nor the people by themselves can hope to achieve victory except by working wholeheartedly together and by both demanding and permitting the fullest possible utilization of the potentialities on both sides. Neither can be deficient without impairing the efficiency of the other.

As a member of the American Association of Scientific Workers and an active worker in the War Effort Committee of its New York branch, I should like to speak for the "people" in science. I urge them to cooperate wholeheartedly in the war effort; and I urge the leadership in science to demand and to permit that whole-hearted cooperation. I offer constructive suggestions as to ways and means, based on the experiences of the association.

The American Association of Scientific Workers has been increasingly concerned with the problem of complete utilization of scientific resources in the war effort, especially from the standpoint of facilitating and encouraging volunteer work by individual scientists and local groups. Although small in scale and more fruitful up to the present in promise than in accomplishment, our activity has convinced us both of the need for work of this kind and of the practicability of our approach. Extension of such activity on a larger scale will, we feel sure, bring concrete results that will exert a very appreciable influence on the total war effort.

The association has endeavored to present the problem of the utilization of scientific resources as a basis for action. Communications on the subject have been

published;² and a memorandum submitted to the National Academy of Sciences on July 30 suggested means whereby the academy and other leading scientific bodies might aid directly in solving the problem.

What is the current extent of failure to utilize our resources of science? More precisely, what proportion of our total scientific man-hours and equipment-hours is being unused or used for non-essential or non-contributory purposes—for "business as usual"? Unfortunately, in the absence of adequate statistical data, no such precise formulation is yet possible. Compilation of these data is badly needed. It is nevertheless possible to define the problem from the experience of the association with sufficient clarity for the present purpose.

Certain fields of science are being very largely utilized for war purposes. Workers in the physical and mathematical sciences, engineers, and physicians, dentists and veterinarians have been absorbed into the war effort so rapidly that shortages in these fields on the home front are actually becoming critical. Such shortages, especially of physicians, may depend in part upon an aggravation of previously existing faults of distribution, and may therefore reflect the problem of efficient utilization as much as that of simple conversion of personnel from peacetime to wartime work. In these fields, at all events, the chief problems appear to be those of most effective utilization of the limited resources that are available, and of maintenance of the supply of trained personnel by accelerated education. These are the front-line sciences; their need for the war effort is most immediately apparent.

Among chemists, on the other hand, our experience shows more "business as usual" than we have any right to tolerate. Chemists contribute to both the physical-engineering and the medical front lines. Their importance, in chemical warfare itself, in the development and improvement of synthetic and substitute materials such as rubber and of therapeutic agents and other biological products, needs no extended emphasis. As might be expected, more complete use has been found in war work for physical chemists than for those in other categories. There should be room in the war effort, however, for competent chemists of all kinds. There is no doubt that not all competent chemists are being so used.

The medical sciences seem to be still further behind the goal of full utilization. These sciences, including physiology, biochemistry and bacteriology, are to medicine what production, development and invention are to ordnance. They are being utilized under the effective leadership of the Committee on Medical Re-

² (a) J. E. Hawkins, *SCIENCE*, 95: 2472, 507-508, May 15, 1942; (b) C. Behre, H. Grundfest and E. A. Kabat, *ibid.*, 96: 2479, 16, July 3, 1942; (c) H. Grundfest, *ibid.*, 96: 2492, 318-319, October 2, 1942.

search, one of the two major subdivisions of the government's Office of Scientific Research and Development. Many problems in important fields have been allocated and are being worked on, including means for control of many infectious diseases, the handling of war injuries and burns, the causes and control of shock, the storage and preservation of blood and the use of blood substitutes, and the control of nutritional deficiencies. In medical schools, moreover, scientific workers, who are nearly always teachers as well, have been given less time for research in the accelerated program of teaching. There are nevertheless many competent medical scientists who have time for research and who have not yet been utilized for war work. Their research continues on a "business as usual" basis, rarely by choice, but because the CMR has not reached them with problems, and because they themselves have not known how to find war work.

Among the subdivisions of biological science other than those directly contributory to medicine the problem of utilization is evidently still more serious. Biologists and agricultural scientists have no central government agency like the CMR, with money to spend and power to initiate and coordinate war research. They recognize the need for work on such problems as the new or improved production and conservation of natural materials like foods, fiber, forest products and rubber, and the ecology of animal and insect agents and carriers of disease. By and large they have not been able to initiate intensive study of these problems. As individuals they are still largely unused in the war effort, clearly not because of any lack of willingness on their part, but because the means for their conversion from a peacetime to a war-time basis have not yet been found or made available.

These are the broad outlines of the problem. Science is basic to the war effort. A vast amount of scientific research and development work has been and is being allocated, implemented and coordinated under the leadership of the OSRD and through its two major committees, the National Defense Research Committee (for physical sciences) and the Committee on Medical Research, cooperating through the National Research Council with many subcommittees for individual fields. It implies no serious criticism of this leadership to point out that its efforts to date afford no basis for complacency. Many of our scientific resources have not yet been utilized. We can not afford to waste any of them in total war. It can not be seriously argued that all the really important problems have been assigned or that all the really competent scientists have been absorbed into war work. This would be complacency at its worst, equivalent to the view, now seldom expressed, that the Army and Navy will fight the war for us, and the people may rest. The people have too much at stake to rest while

they can help. Unused scientific resources are unconscionable in total war.

Leadership alone, however competent, is not enough; and if it were to attempt to work alone, without exploring and opening all possible avenues for cooperation from below, it would be shirking an indispensable part of its duty. The OSRD and its supporting agencies can not be expected to envisage all possible scientific war work, or to reach down to every scientific worker and find the proper job for him, without requiring, or at least encouraging, each individual worker to find his own place and to help others to do likewise. Fortunately the manner in which the OSRD operates includes provision for just such individual volunteer effort. Any responsible scientific worker can formulate a war project and submit it as an application for a contract to the OSRD or to one of its subcommittees. If the application is approved a contract is granted, and funds for assisting personnel and for equipment and supplies are made available for the work. This provision for volunteer effort, however, has not been widely publicized, and does not seem to have been put into practice on an extensive scale. Its usefulness has been impaired by the requirement of secrecy imposed on war research by the military authorities. Because much current research remains unpublished, scientific workers fully conversant with the literature in their fields may be unable to determine whether a given problem is already being investigated, and through fear of useless duplication may fail to apply for an important contract. We do not question the need for secrecy in many war research problems; but our experience suggests that secrecy regulations have not been adequately clarified, and that in many instances the restrictions in practice are much more severe than either the regulations or the needs require.

Recent experiences of a group of bacteriologists in New York indicate some of the means that are waiting to be used to encourage and facilitate volunteer scientific activity. This group was organized through the efforts of the New York branch of the association, as an outgrowth of the experience of its war effort committee, and is now an autonomous body. Its purpose is to consider aspects of bacteriology and related sciences that are of current war importance, and from open discussions to formulate war research projects that can be undertaken by members of the group after approval by the OSRD. A meeting held September 23 for discussion of vaccines against enteric infections was attended by more than two hundred bacteriologists, immunologists, pathologists and biochemists. Two invited speakers presented complementary aspects of the subject. During more than an hour of discussion from the floor after the presentations, seven problems in the field were suggested. A repre-

representative of the Army Medical School who attended the meeting by invitation offered the facilities of his laboratories for cooperation on several of the problems, and pointed out that one of them was currently being investigated. The other six were then allocated to committees of volunteers from among those present for separate detailed consideration with a view to preparation of OSRD contract applications.

Activities of this kind could well be set up elsewhere and in other fields of science. They require only that a small group of persons in the field undertake the work of organization and the responsibility of seeing their work through to a fruitful conclusion. They should be encouraged, if not actively aided, by the scientific leadership of the country. Secrecy regulations are an obstacle to their progress, but not an insurmountable one. The details of many researches are necessarily secret, but the subject as a whole can generally be discussed openly without departing from the spirit of the regulations, and the gaps that require investigation can be indicated or sought by those in attendance. Cooperation such as the bacteriologists' group has received from informed persons who can help to eliminate duplication and to encourage useful projects is of the greatest value, and can probably be obtained with less difficulty than may be imagined.

There is encouraging evidence that this kind of volunteer activity meets a real need, both of the many individual scientific workers who are eager to participate in war research and will cooperate gladly in such an undertaking, and of those charged with the leadership of science in the war effort, who will recognize here a means to relieve themselves of part of their great responsibility, and to insure the more perfect fulfilment of the enormous task that has been assigned to them.

The fuller utilization of scientific resources implies more than research and more than the activities of scientific personnel. What of scientific work other than research? And what of the full utilization of scientific facilities, equipment and materials? The association has considered aspects of both questions.

Scientific workers who lack the facilities or the qualifications for war research can find work on the home front that makes use of their special skills, and which therefore can not be done by others not so qualified. They can aid in the training of civilian defense workers, or participate directly in local civilian defense organizations as gas detection experts, medical assistants or engineers for control or rehabilitation in disaster areas after enemy attack. They can prepare directions and help to institute precautions for storage or disposal of potentially dangerous materials in laboratories, factories and homes. Many scientists as individuals are now active in such work. The New York branch of the association is

currently projecting plans for the more wide-spread utilization of scientific workers in such activities.

Scientists can also be of service by preparing pamphlets or books embodying popularizations of scientific data for the use of civilian defense workers and for education and morale-building among the armed forces. The Boston-Cambridge branch of the association has prepared a popular book on "Science from Shipboard" which is soon to be published by the Red Cross for distribution to soldiers aboard transports. Other branches are planning analogous books and pamphlets.

Sooner or later scientists will need to be concerned with problems that result from shortages of trained personnel on the home front. Aside from those means for overcoming shortages by rapid replacement through accelerated and improved education, means for substitution may also be available. A committee of the New York branch of the association has surveyed this problem as it affects the shortage of medical personnel in hospitals, and has considered the possibilities for substitution of technicians to perform many of the duties customarily undertaken by interns. Similar shortages may be expected to develop in civilian engineering activity, and may be met in part by parallel substitutions. Shortages of physicists, both in college teaching and in research, might be alleviated by substitution of workers in biology, chemistry and geology who have the necessary qualifications.^{2c}

Another activity in which volunteer scientific effort can be used to good advantage to supplement centralized leadership is that of ensuring the full utilization of scientific facilities, equipment and materials. Shortages of metals and rubber and the conversion of industry to war production are rapidly making many types of apparatus unobtainable, and there are indications that other materials, such as certain organic chemical reagents, may soon disappear from the market. Critical shortages are bound to develop in some laboratories, while others either have the required equipment without using it or have the facilities for its production or synthesis. The National Registry of Rare Chemicals, maintained under the auspices of the Armour Foundation, grew directly out of the efforts of the Chicago branch of the association, and has become an important step toward the alleviation of one type of shortage, with a present listing of over three thousand items. A committee of the New York branch, cooperating with the committee designated for the purpose by the National Research Council, is now preparing local registries both of unused scientific equipment and of the need for unobtainable articles, as a basis for the necessary exchanges, perhaps by a "lend-lease" arrangement. This local effort, following and expanding plans

worked out by the Purdue branch of the association, is expected to provide a background of experience for a much more wide-spread survey that may soon become essential.

Beyond the goal of full utilization of scientific resources, in terms of the full-time employment in war work of all available personnel and materials, lies the problem of the most efficient utilization of these resources. Men and machines capable of more important war work than that being done may have to be converted further from the less to the more urgent tasks. One aspect of this problem has been mentioned in relation to the current shortage of physicians. Ultimately, as the exigencies imposed by total war become more and more apparent, and as the need for outright conversion of all science to war purposes is made inescapable, it may become imperative that all scientific activity be centralized and coordinated by a single government agency. A bill (S.2721) with essentially this purpose was introduced by Senator Kilgore on August 17, and has been referred to the Senate Committee on Military Affairs. The bill provides for a single government authority to survey, mobilize and coordinate all technological personnel and facilities of the nation for a maximum war effort.

Certain changes in it appear desirable, particularly to remove its ambiguity with respect to the medical and biological sciences, and to insure continuity of the functions and adequate coordination of government agencies which now exist for the utilization of scientific resources.³ It behooves all scientific workers to study this bill closely, since it affects their interests directly and embodies sweeping changes in their peacetime habits of life. If the "Office of Technological Mobilization" called for in the bill, or an analogous centralized government office of science, ever becomes a reality, the basis laid by expanded volunteer scientific work as outlined in this paper will take its place alongside the OSRD, the National Roster, and other official and semi-official government agencies as invaluable experience and as mechanisms in actual operation that may be expected to fit into the new centralized scheme with a minimum of alteration. All these efforts have their place in promoting the full utilization of scientific resources for total war. Volunteer effort, stimulated and guided from above, is not the least of them, and merits more attention as an essential part of this process of conversion of science to war than has heretofore been accorded to it.

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

DR. ARTHUR P. HONESS, professor of mineralogy and petrology at the Pennsylvania State College, died on October 17, at the age of fifty-five years.

DR. FRANZ C. SCHMELKES, assistant director of research of Wallace and Tiernan Company, Inc., manufacturers of pharmaceutical products and water-purifying apparatus, died on December 11. He was forty-three years old.

DR. MAX HARRISON DEMOREST, until recently instructor in geology at Wesleyan University, known for his researches in glaciology, according to information received from the War Department, died on November 30 in Greenland, where he was serving as a specialist with the rank of First Lieutenant at a remote military outpost. He was thirty-two years old.

PROFESSOR WILMOT V. METCALF died on November 21, at the age of eighty-two years. He had taught chemistry and physics at Whitman College, Carleton College, Fisk University and Berea College. His training included a bachelor's and master's degree at Oberlin College, the doctorate from Johns Hopkins, a year's post-doctorate study at Wurzburg and two years at Leipzig. In 1917, after persistent but unsuccessful efforts to enlist at the age of fifty-seven years, he volunteered for service with an ambulance

unit and served for a time in France, paying all his own expenses. Later he served with the Army Y.M.C.A., his special interest being in personally delivering Y.M.C.A. supplies to the boys in the front-line trenches. Professor Metcalf's professional field was physical chemistry. Early in life he became interested in the philosophy of science. He was studying zealously in that field at the time of his death, having maintained a wide correspondence on the subject and contributed a number of papers to scientific and philosophical magazines in recent years. Professor Metcalf was the older brother of Maynard M. Metcalf, the zoologist, who died in 1940.—LLOYD W. TAYLOR.

A CORRESPONDENT writes: Robert Peele, who died at his home in New York City on December 8, in his eighty-fifth year, had been emeritus professor of mining of Columbia University since 1925 and a member of its staff since 1892. A graduate of the School of Mines with the class of 1883, after ten years of varied professional experience in the United States and South America, he was appointed adjunct professor in 1892

³ Since this paper was presented, another bill has been introduced by Representative Tolan and by Senators Kilgore and Pepper. The Tolan-Kilgore bill embraces provisions similar to those of the original Kilgore bill, but as part of a broad program for total mobilization of the nation's manpower and resources. The modifications in the Kilgore bill referred to above have been largely included in the newer bill.

and made full professor in 1904. His many former students will remember him best for his conduct, for thirty years, of the supervised and directed summer school work in the field, where he trained them in accurate analysis and observation, and the precise recording of data. He published his two books, "Compressed Air Plant," 1908, and "The Mining Engineers' Handbook," 1918, both of which have gone through several subsequent editions. He was awarded the gold medal of the Mining and Metallurgical Society of America in 1922, the Eggleston Medal of the Engineering Alumni Association of Columbia University in 1939, and was made an honorary member of the American Institute of Mining Engineers in 1935.

A WIRELESS dispatch from London under date of December 13 to *The New York Times* reads: "Tercenary observances of the birth of Sir Isaac Newton were begun to-day at Grantham, near the peaceful hamlet of Woolsthorpe-by-Colsterworth, where the scientist was born. As townspeople and others, including Sir Henry Dale, president of the Royal Society, looked on, a laurel wreath was laid at the foot of Grantham's statue of Sir Isaac, which has been denuded of ornamental railings formerly surrounding it. The honor of laying the wreath fell to a youngster named J. H. Foster, head boy of King's School, where Newton received his early education. Newton's birthday was Christmas Day, 1642, but so many observances had been planned that it was decided to start them to-day. At church services at Grantham this morning, the Right Rev. A. A. Markham, of Stoke Rochford, Bishop of Grantham, offered special prayers 'in thankful remembrance of Isaac Newton' and 'for the right use of science.'"

THE BRITISH TECHNICAL ADVISORY COMMITTEE ON NUTRITION

THE work of the first meeting, recently held in London, of the British Technical Advisory Committee on Nutrition to investigate the post-war nutritional needs of European countries overrun by the Axis nations, is reported in *The Times*, London.

The Nutrition Committee is one of five technical advisory committees which work in conjunction with the Allied Post-War Requirements Bureau, the organization set up as a result of the St. James's Palace conference of September 24, 1941.

At an early stage the bureau set up a technical advisory committee on agriculture under the chairmanship of Sir John Russell, director of the Rothamsted Experimental Station. This committee has already completed a report on seed requirements needed in Europe after the close of hostilities, and is now investigating the problems of restoring live-stock herds, training tractor drivers, supplying agricultural machinery and estimating likely fertilizer needs.

Within the past few weeks other technical advisory committees have been set up to deal with such matters as inland transport and medical needs. The committee is composed of transport experts of those allies who are most intimately concerned with post-war conditions in Europe.

The medical committee has decided upon a basic list of 59 drugs, showing the total quantities required per 100,000 of population for the first month after liberation. Further lists for those special areas where diseases are endemic or epidemic are now under consideration.

It has been realized from the outset that considerable help in the bringing of relief to occupied regions can be given by British and international voluntary societies, and the bureau maintains close contact with a Consultative Council on which such voluntary societies are represented.

RURAL LAND USE

COMPREHENSIVE programs of post-war public construction to conserve and improve rural lands are outlined in "Public Works and Rural Land Use," a report transmitted to the President by the National Resources Planning Board, recently made public. The board in its letter of transmittal said:

The importance of this statement at this time lies in the clear indication which it provides of the needs and possibilities for activity after the war to develop these basic resources. We hope the report may stimulate the preparation now of plans for rural works of tested merit which can be undertaken when the war is won.

Although the report is not primarily concerned with public land acquisition, it does contain a discussion of public land acquisition as one of the effective tools for facilitating land-use adjustment. It is noted, for example, that of the 1,900,000,000 acres of land in Continental United States 415,000,000 acres are classified as crop land, of this crop land total 339,000,000 acres or 82 per cent. are suitable for cultivation under appropriate soil conservation practices, and the remaining 76,000,000 acres are classified as land which could not be cultivated safely and profitably under normal prices. Our policy with respect to rural public works must therefore take into account the following:

- (1) Promotion of those public works and undertakings required to conserve and improve crop lands suitable for cultivation, forest lands and range lands.
- (2) Public acquisition of submarginal crop lands and their conversion to more suitable land uses.

This report, which forms a part of the National Resources Planning Board program of post-war planning was prepared under the direction of the Land Committee of the board, by representatives of construction agencies in the Department of Agriculture and by the Department of the Interior. It consists of five statements, covering public construction on

agricultural, grazing, forest, recreational and wildlife lands. Each statement outlines the general objectives of the program of land conservation, development and economic use in the field covered, indicates the types of public works which contribute toward accomplishment of this program and sets forth certain standards for evaluating individual works projects of various types.

THE COLLEGE OF MEDICINE OF THE UNIVERSITY OF ILLINOIS

CHARGES that the University of Illinois had deteriorated during the past eight years as the result of political activity by the board of trustees resulted in action by the board at its June, 1942, meeting inviting the American Council on Education and the American Medical Association to investigate the university. The American Council on Education has not yet reported, but the American Medical Association has submitted an elaborate report after an exhaustive study of the College of Medicine. According to this report,

the College of Medicine is an integral part of the University of Illinois, a state-owned institution, controlled by an elected board of trustees, of which Dr. Karl Meyer, Chicago, is president. There is apparently being effected a rather progressive reorganization of the curriculum which promises much more satisfactory clinical training during the third and fourth years than was possible at the time of the last visit (1935). Members of the faculty, both preclinical and clinical, are in general outstanding and competent men who appear to be greatly interested in teaching, and it would appear that the heads of practically all the clinical departments recognize the need for additional clinical facilities under their immediate supervision.

There is being developed in connection with the dental, medical and pharmacy schools, correlated, cooperative and even integrated teaching programs. The school is to be commended for undertaking this interesting experiment which should be a real contribution to professional education.

Further developments are currently being effected or studied and these promise to offer unusual opportunities in the fields of both undergraduate and graduate medical education.

The physical plant for the preclinical departments is apparently satisfactory, and the departments of pathology and bacteriology which were very unsatisfactorily housed

at the time of the previous visit now have satisfactory quarters.

Dr. Raymond B. Allen, executive dean of the three Chicago colleges of the University of Illinois, is reported to have said:

In no important particular has the report brought forth any facts or conclusions about which the university has been unaware or about which something has not or is not being done. Many of the suggestions for further improvement must await sufficient financial aid. Nevertheless, it is invaluable to have outside agencies express their unbiased, informed judgment as exemplified in this report.

THE SEMI-CENTENNIAL OF THE MEDICAL SCHOOL OF THE UNIVERSITY OF TEXAS

A SPECIAL war program for the Semi-Centennial graduation exercises of the University of Texas Medical School, Galveston, was held on December 18. At the morning session Dr. Chauncey D. Leake, dean and vice-president, welcomed those in attendance with a discussion on the medical responsibilities of war. Dr. E. H. Cary, professor of oto-rhino-laryngology at the Baylor University Medical School, Dallas, past-president of the American Medical Association, spoke on "The Role of the Specialist in Military Medicine," and Dr. I. S. Ravdin, Lieutenant Colonel, M.C., professor of surgery at the University of Pennsylvania, gave an address entitled "A New Era in Military Surgery." At the afternoon session, Dr. C. C. Sturgis, professor of medicine at the University of Michigan, discussed blood and substitutes in shock. A survey of wound healing was given by Dr. Alton Ochsner, professor of surgery at the Medical School of Tulane University. Dr. F. G. Ebaugh, Lieutenant Colonel, M.C., professor of psychiatry at the Medical School of the University of Colorado, spoke on "Psychiatry and War." The scientific session was concluded by a consideration of "Obstacles in the Path of an Optimum Diet," by Dr. A. J. Carlson, Hixson distinguished service professor of physiology of the University of Chicago. At the graduation exercises in the evening, Dr. Judson L. Taylor, Lieutenant Commander, M.C., president of the Texas State Medical Association, will give the address. Honor guests on the occasion will be Dr. Edward Randall, professor of therapeutics emeritus, and Dr. Seth M. Morris, professor of ophthalmology emeritus, who are two living members from the original faculty of the school.

SCIENTIFIC NOTES AND NEWS

IGOR I. SIKORSKY was presented on December 7 with the Sylvanus Albert Reed Award for 1942 of the Institute of the Aeronautical Sciences. It carries an honorarium of \$250 and is made annually for "a notable contribution to the aeronautical sciences whose

practical value is apparent." The award was made in recognition of work on "the creation and reduction to successful practice of a helicopter of superior controllability." The presentation was made on the same occasion as the delivery by Edmund D. Allen of the

sixth annual Wright Brothers Lecture at Columbia University, which provides the sum of \$250 for the lecturer.

THE American Pharmaceutical Manufacturers' Association presented its annual award of distinction on December 7 to Dr. Edward A. Doisy, of St. Louis University, "in recognition of his isolation in pure form of the female sex hormone estrone (theelin) and his other valuable contributions to knowledge of estrogenic substances important in therapy and research." Dr. Torald S. Sollmann, dean and professor of pharmacology and materia medica at the School of Medicine of Western Reserve University and chairman of the council of pharmacy and chemistry of the American Medical Association, made the presentation address. It was entitled "Those Busy Hormones." Other speakers and their subjects were: Dr. George R. Cowgill, associate professor of physiological chemistry at the School of Medicine of Yale University, hormone developments; Dr. Oscar Riddle, of the Station for Experimental Evolution of the Carnegie Institution at Cold Spring Harbor, N. Y., hormone therapy, and Dr. Ephraim Shorr, associate professor of medicine at Cornell University Medical College, the future of hormone therapy. Dr. Doisy, in reply, gave a brief history of his experiments.

DURING the convocation of the University of Chicago, Katharine Lenroot, chief of the Children's Bureau of the Department of Labor, was presented with the Rosenberger Medal "for notably great service in the promotion of human welfare."

THE Council of the British Royal Meteorological Society has awarded the Buchan Prize for 1943 to Dr. T. E. W. Schumann and Gordon Manley.

DR. GEORGE D. STODDARD, Commissioner of Education of the State of New York, previously dean of the Graduate College and director of the Child Welfare Station of the State University of Iowa, was awarded the honorary degree of doctor of laws at the commencement exercises on December 13 of Hobart and William Smith Colleges, where he delivered the Phi Beta Kappa address.

DR. LEWIS SELKIRK COONLEY, associate professor of chemical engineering at the Rensselaer Polytechnic Institute, has been made chairman of the department. He succeeds Dr. Albert Watson Davison, who has been named director of research for the Owens-Corning Fibreglas Corporation.

SIR J. DONALD POLLOCK, Bt., M.D., has been re-elected rector of the University of Edinburgh.

DR. THOMAS T. READ, Vinton professor of mining engineering at Columbia University, has been appointed consultant in the education and allocation of

engineers in the office of the director of operations of the War Manpower Commission.

DR. JOHN G. BROUGHTON, of Rome, N. Y., has been appointed to the newly established position of assistant state geologist of New York.

DR. NORBERT FELL, who joined the Research Staff of Parke, Davis and Company in 1936 as a biochemist and subsequently developed a research division devoted to immunochemistry, has been promoted to the position of director of the department of biological manufacturing.

DR. HERALD R. COX, formerly principal bacteriologist of the Rocky Mountain Laboratory of the U. S. Public Health Service, Hamilton, Mont., has joined the staff of the Lederle Laboratories, Pearl River, N. Y., as associate director of research in charge of virus and rickettsial diseases.

LORD ONSLOW has resigned the presidency of the Zoological Society, London, for reasons of health, and Henry Gascoyen Maurice has been elected president until next April.

THE Earl of Moray and J. M. Bannerman have been appointed members of the British Forestry Commission in succession to Sir John Sutherland, who has submitted his resignation.

A COMMITTEE under the chairmanship of Dr. Henry Lewis Guy, engineer of the mechanical department of the Vickers Company, was recently appointed by the British Minister of Supply to review machinery for the conduct of research, design and experimental work in connection with the development of guns, small arms and ammunition. As a result of the committee's recommendations, the Minister of Supply has appointed Professor John Edward Lennard-Jones, F.R.S., Plummer professor of theoretical chemistry at the University of Cambridge, to be chief superintendent of armament research, and F. E. Smith, of Imperial Chemical Industries, Limited, to the post of chief engineer and superintendent of armament design.

DR. H. S. SOUTTAR, chairman of the Council of the British Medical Association and chairman of the Central Medical War Committee, has been made chairman of a mission to report on the medical services for the armed forces in India. During his absence Professor R. M. F. Picken has been appointed acting chairman of council.

DR. WALTER PATRICK, professor of physical chemistry at the Johns Hopkins University, gave on December 11 the annual Alpha Chi Sigma lecture in chemistry at Syracuse University. The lectureship was established with the purpose of bringing back

to the university each year a distinguished alumnus in chemistry. Dr. Patrick spoke on "The Hydration of Ions."

DR. CAREY CRONEIS, professor of geology at the University of Chicago, during the interim between November 27 and December 7 addressed the local geological societies at Centralia, Ill.; Wichita, Kans.; Tulsa, Okla.; Dallas, Ft. Worth, Midland, San Antonio and Houston, Texas; and Shreveport, La., on "Geological Warfare," as a part of the distinguished lecture program of the American Association of Petroleum Geologists.

DR. WILLIAM CRAMER, of the Barnard Free Skin and Cancer Hospital, St. Louis, delivered on December 2, at the University of Missouri, a lecture on "Cancer as a Biological Problem" at a meeting of the Missouri Chapter of the Society of Sigma Xi.

ON October 27, Dr. Hilton A. Smith, professor of chemistry at the University of Tennessee, addressed the Sigma Xi Club of the University of Tennessee and the East Tennessee Branch of the American Chemical Society on "Catalytic Hydrogenation." On December 1, Dr. Dorothy E. Williams, nutrition chemist at the Agricultural Experiment Station of the University of Tennessee, spoke on "Phosphate Nutrition Research."

PROFESSOR A. H. REGINALD BULLER, professor emeritus of botany at the University of Manitoba, recently gave two public lectures at Cornell University on the Jacob H. Schiff Foundation. The subjects of the lectures were "The Sexual Process in the Rust Fungi (Uredinales)" and "Recent Discoveries Concerning the Bird's Nest Fungi (Nidulariaceae)."

A DINNER in honor of Alfred Nobel, founder of the Nobel Prizes, who died in 1896, was held in New York on December 10. The speakers included Pearl Buck, Dr. Harold C. Urey, Thomas Mann and Norman Angell.

It is announced that by vote of the executive committee, the Federation of American Societies of Experimental Biology, which includes the American Physiological Society, the American Society of Biological Chemists, the American Society for Pharmacology and Experimental Therapeutics, the American Society for Experimental Pathology, the American Institute of Nutrition and the American Society of Immunologists, will omit the meeting which was scheduled to be held in Cleveland from April 6 to 10, 1943. This action applies only to the federation as such and does not cover any meetings which may be organized by the constituent societies. It is further announced that provision will be made for publication in the Federation Proceedings of abstracts of such

papers as would have been offered for presentation if a federation meeting had been held or which may be offered for presentation at meetings of the constituent societies. These abstracts will be received by the secretaries of the constituent societies in the customary manner according to notices to be sent to the memberships.

THE annual meeting of the American Association of University Professors, scheduled for December 28 and 29 in Cleveland, Ohio, has been cancelled. This action was taken in compliance with a request from the Office of Defense Transportation. Election of council members and voting on pending constitutional amendments will be conducted by mail. Ballots for this purpose will be sent to members early in January.

The Experiment Station Record reports that the Kansas State College Research Foundation has been organized, with President F. D. Farrell as chairman of a board of nine directors. Its charter is said to follow closely those of like organizations at a number of land-grant institutions.

DR. E. D. MERRILL, director of the Arnold Arboretum and administrator of botanical collections, Harvard University, has nearly completed a special emergency food manual for the War Department, covering the Polynesian, Micronesian and southwestern Pacific areas. This will later be extended to cover the entire Malayan region. The task was undertaken at the request of the War Department through the National Research Council. The tender stems, leaves, flowers, fruits, seeds and underground parts of a great variety of native and introduced species are currently used by the natives of the regions covered, to supplement their daily diet. A selection of the more common and widely distributed species, with illustrations, simple statements covering the parts used, special methods of preparation where indicated and the habitats in which the species occur indicates its scope.

AN American Standard governing letter symbols for mechanics of solid bodies has been approved and published by the American Standards Association. In addition to the sixty-eight letter symbols approved to indicate such concepts as angular acceleration, circular frequency, factor of safety, normal strain, wavelength and the like, the new standard cites general principles of letter symbol standardization governing manuscripts, subscripts, superscripts, unlisted magnitudes and typography. The new standard was prepared by the Sectional Committee on Letter Symbols and Abbreviations for Science and Engineering, under the joint technical leadership of the American Association for the Advancement of Science, the American Institute of Electrical Engineers, the Ameri-

can Society of Civil Engineers, the Society for the Promotion of Engineering Education and the American Society of Mechanical Engineers.

THE Buenos Aires correspondent of the *Journal* of the American Medical Association writes: "The scientific relations between Argentina and Brazil are close. Groups of physicians of each country make visits to the other country for the exchange of scientific knowledge. Books of Brazilian medicine have been recently translated into Spanish under the honorary direction of Dr. Mariano Castex, professor of clinical medicine of the Faculty of Medicine of Buenos Aires, and under the active direction of Dr. Egidio S. Mazzei and Elyeser Magalhaes. The volumes of this collection have been translated into Spanish with the aim of enabling Spanish-speaking physicians to know some of the most important books of their Brazilian colleagues. Dr. José Silveira's book, 'Atelectasia y

Tuberculosis Pulmonar,' is the first one of this collection to be translated. Three other books are going to be translated and published in the near future: (1) 'Enfermedades del Hígado: Diagnóstico, Patología, Terapéutica,' by Dr. Clementino Fraga; (2) 'Aneurismas Aórticos,' by Dr. A. de Almeida Prado, and (3) 'Propedéutica Radiológica,' by Professor Manuel de Abreu. All these books are edited by the publishing house 'El Ateneo' of Buenos Aires."

The Times, London, reports that as a gesture of appreciation from British doctors to their colleagues in Russia a book containing articles on British war medicine has been prepared by the Anglo-Soviet Medical Council. The council held a reception in London on November 23, when Madame Maisky was presented with the book and the Honorable Ivor Montagu spoke on "Scientific and Educational Films in the U.S.S.R."

DISCUSSION

SORA, NEAR-VICTIM OF A FISH

ON September 15, 1942, an immature male specimen of sora (*Porzana carolina*) was transmitted to the New York State Museum by Vernon Haskins, of East Durham, Greene County, New York. This bird was recovered from the highway near his home, where evidently it had been struck by a passing automobile the preceding night. The carcass was intact and examination of the internal organs revealed only slight trauma and bleeding with the skeletal parts in perfect



FIG. 1. Left tarsus of sora showing position of the fish tooth; also a lateral view of the tooth itself. About two-thirds natural size.

condition. Measurements in millimeters are as follows: length, 203; wing, 109; tail, 53; tarsus, 29; bill, 19. The bird was very fat and weighed 73.4 grams.

Upon skinning the rail an interesting point came to light. One-half inch below the proximal end of the posterior aspect of the left tibio-tarsus a small, slightly curved and sharply pointed tooth-like structure had pierced both sides of the tarsal envelope and

the contained tendon. The point of this foreign element had entered from the outer side of the tarsus and projected for a distance of about one millimeter beyond the inner tarsal covering. Hidden beneath the outer tarsal covering was the base of the element. Some slight discoloration marked its points of entrance and exit.

Removal and detailed examination of the offending foreign body revealed that it was the tooth of a fish, evidently a northern or some other species of pike (*Esox*). The broad base, shape, peculiar curvature, vertical basal striations and evident mode of insertion all provide evidence for this conclusion. The original length of this tooth was about 6 millimeters and the greatest basal width 1.5 millimeters; unfortunately, its extreme tip—perhaps one-half millimeter in length—was accidentally broken off at the time the tooth was extracted from the tarsus.

That the injury had been suffered not long before was evident from the still slightly blood-red internal appearance of the recently lost tooth and the fairly fresh condition of the rail's small leg wound. Since the tooth either had penetrated or abraded the tendon, it is possible that in walking the bird had suffered some slight inconvenience or possibly pain.

One can only surmise the manner in which the tooth became thus embedded in the leg of the rail. It is well known that pike are voracious feeders with carnivorous proclivities. The available evidence suggests that the bird while walking in the water may have been set upon by one of these fish which scored only a "near miss" for its efforts. Later, the rail suffered an even more ignominious end as the victim of a speeding motor car.

The sora here discussed is now included in the

zoological exhibit collections of the New York State Museum, Accession No. 6342.

DAYTON STONER
LOUIS J. KOSTER

NEW YORK STATE MUSEUM,
ALBANY

THE TROPICAL CHIGOE IN CALIFORNIA

Tunga penetrans (Linnaeus), a tropical and sub-tropical siphonapterous pest, commonly known as chigger, jigger, chigoe or sand flea, has heretofore remained unreported as adult from the continental United States,¹ except for one case from New Orleans.² Thirteen gravid females³ were recently (April 7, 1942) recovered from the eyelids of a Pacific horned owl (*Bubo virginianus pacificus* Cassin), at Oceanside, San Diego County, California, by Kenneth Stager.

The life history and etiology of this flea³ are of special interest in the present emergency. Its habitat is essentially warm, dry, sandy places. Although considered free living as larvae (with the one reported exception²), adults attack not only birds, but also other warm-blooded animals, including man. Though not known to be a vector of pathogenic organisms, its entry beneath the epidermis and invasion of the stratum lucidum produces irritating skin ulcers which are frequently complicated by secondary invaders.

Southern California is known to have many outdoor camping grounds. Camp directors should therefore be on the alert for its possible appearance in infested areas. Also, with the erection of many open-air military camps in the southwest, it seems particularly desirable that special studies as to the distribution in this country be made, and precautions taken to prevent its spread.

G. F. AUGUSTSON

ALLAN HANCOCK FOUNDATION,
UNIVERSITY OF SOUTHERN CALIFORNIA

ON NUMBERING BOOK ILLUSTRATIONS

I AM reading a book on meteorology, and I come upon this sentence, "Fig. 50b shows the typical features of a towering cumulus (see also Fig. 25)." Now Fig. 50b is right under the eye; but Fig. 25? Evi-

dently it is somewhere in the fore part of the book. I am at page 81, and I make a chance dive into the earlier pages and come upon page 47. It happens to carry Fig. 32. So I thumb my way back page by page until I come to Fig. 25 on page 32. This happens to be a small book; in one of 600 pages it would be a longer chase. Now this all takes time, interrupts the attention and, with me, gives rise to an emotional turbulence which may eventuate in profanity. I am sure that many others have had the same experience, barring perhaps the emotional turbulence. "A law ought to be passed," not against the use of profanity under such circumstances, but against the use of a separate series of numbers for illustrations.

For there is no logical reason for a separate numbering of the illustrations. They are not regularly spaced as are the pages. One can not at once turn to a numbered figure in a distant part of the book, as he can to a numbered page. Their use is time-consuming and irritating.

Besides, there is a better way of handling the matter. Figures in the text should be referred to by their page number. Fig. 25, above, would then be Fig. p. 32; or even Fig. 32. One could then turn to it at once. If there were more than one figure on a page they could be distinguished as A, B, C, etc.

This suggestion concerns especially text-books in physical science and technology. It is addressed to the writers and publishers of such books. It is the duty of author and publisher to reduce the effort of the reader in every possible way; and here is one way. Any unnecessary taking of the reader's time and energy is larceny, stealing; is immoral.

Some of the best texts are already dropping the serial numbering of figures. Smith and Phillips's splendid "North America" (Harcourt, Brace and Company) is one: it omits the numbers, and when there is more than one illustration on the page it distinguishes them by letters. The use of the old system of consecutively numbered figures hangs on because of inertia and lack of imagination. Writers of text-books on science ought to be able to climb out of this rut.

LEWIS G. WESTGATE

SCIENTIFIC BOOKS

TOPOLOGY

Algebraic Topology. By SOLOMON LEFSCHETZ. vi+389 pp. Vol. 27. Colloquium Publications of the American Mathematical Society. 1942. \$6.00.

¹I. Fox, "Fleas of Eastern United States," p. 12. Iowa State Coll. Press, Ames, Iowa, 1940.

²E. C. Faust and T. A. Maxwell, Report of a case, *Arch. Dermat. Syph.*, pp. 94-97, 1930.

³P. H. Manson-Bahr, "Manson's Tropical Diseases. A Manual of the Diseases of Warm Climates." Eleventh

Analytic Topology. By G. T. WHYBURN. x+278 pp. Vol. 28. Colloquium Publications of the American Mathematical Society. 1942. \$4.75.

THESE two mathematical volumes, written by lead-edition. Williams and Wilkins Company, pp. 700-703, 1940.

^aAfter proof was received, a communication (in litt.) from the U. S. Health Service in Montana suggests this might be *Hectopsylla psittaci*, a nearly related flea from South America. Without males certain identity is difficult.

ers in their respective fields of algebraic and analytic topology, constitute another notable addition to the series of Colloquium Publications of the American Mathematical Society. There has been an extensive forward movement in the field of topology (formerly called "analysis situs") during the present century, in which Russian, Polish and American mathematicians have played a conspicuous part. In all probability these two volumes represent a kind of culmination of the abstract phase in this development.

The scientific public has for some time been aware of the abstract character of much of contemporary mathematics; this has tended to make of their mathematical colleagues a class somewhat apart. The exceeding generality of the ideas involved and the extremely technical and abbreviated terminology employed have been annoying at times, especially to those who believe that the specific situations, which arise naturally, are supremely important and that all really important ideas are basically simple. The answer to such individuals must be that the concrete intellectual object is merely the final definitive form of an abstraction, as illustrated for example by the integer; and that a "simple" concept is only one with which we have become familiar through long use, as, for instance, that of energy in physics.

It appears then that the really significant questions are whether or not topology has attained its approximately definitive abstract form and whether topological concepts are going to prove widely useful. I believe that most mathematicians who know something of the recent work would answer the first question in the affirmative. Moreover, the broad notions of "topological space" and of "metric space" which are given first consideration in both of the volumes deserve to become as well known to the scientific world as that of "linear vector space" of which ordinary Euclidean space serves as the familiar prototype. The "additive group," illustrated by ordinary and angular numbers, is likewise of prime importance. This basic concept of an additive group (in a topological space) is central in algebraic topology and has been much illuminated by the remarkable work of the Russian mathematician Pontrjagin, a good deal of which appears in Lefschetz's book in convenient form.

Broadly speaking, algebraic topology develops the algebraic machinery involved in the dissection into "complexes" and the characterization of the connectivities and other intrinsic properties, of geometric entities—lines, surfaces, solids, etc.—such as are found in ordinary Euclidean space of two or more dimensions. These are regarded only qualitatively, so that a sphere and ellipsoid are not distinguished, while a ring would be regarded as fundamentally dif-

ferent from a sphere. In algebraic topology the basic ideas of "homology" and "homotopy" are derived from that of continuous deformation: thus a small circle on a sphere is said to be homologous to 0, since it can be deformed continuously to a point.

The technical algebraic apparatus involved in homology and homotopy theory was in large part envisaged by Henri Poincaré in his classical five articles on analysis situs (1895–1904). Oswald Veblen through his excellent Colloquium Lectures on "Analysis Situs," published in 1922 and reprinted in 1931, presented the ideas of Poincaré in accurate, improved and suggestive form, and so performed a valuable service for the mathematical world; one recalls also the very useful earlier article by Dehn and Heegard on the same subject in the German Mathematical Encyclopedia. In this way interest was aroused here and abroad. Veblen's work and inspirational influence may properly be regarded as forming the starting point of the many important American contributions to algebraic topology. Lefschetz, with earlier topological investigations to his credit in the field of algebraic geometry, has done much to advance the purely algebraic side of topology.

But while all the abstract focal points involved in algebraic topology have been most successfully highlighted by means of the abstract method in the newer developments presented in Lefschetz's book, one fact needs to be emphasized: the classical open questions noted by Poincaré and others have been left largely untouched. Lefschetz, in referring to the "Poincaré group,"¹ conjectures (p. 310) that "ignorance concerning this group seems to account for the fact that many of the major problems of topology have so far eluded all attempts at solution." It probably has been J. W. Alexander and, more recently, Hassler Whitney who in this country have most advanced toward the solution of such unsolved specific questions. The appearance of Hassler Whitney's forthcoming book on "sphere spaces" will for that reason be awaited with especial interest.

On the other hand, the pure abstractionists have performed beautifully the essential task of giving topological ideas their appropriate abstract setting, and this has been work of the first order of importance.

The volume of Lefschetz owes much to the effective collaboration of various workers in the field and shows the happy effect throughout. Lefschetz mentions especially Samuel Eilenberg, W. W. Flexner,

¹ Typified in the simple case of the circle by the k -fold circuits. Thus a minute-hand makes in one hour one circuit ($k=1$), and makes 24 circuits in a day ($k=24$). Here enters characteristically the "additive group" of the integers in an elementary question of algebraic topology.

N. E. Steenrod, John Tukey and Claude Chevalley. At the end appear two valuable Appendices, one on "homology groups" by Samuel Eilenberg and Saunders MacLane, and the other on "periodic transformations" by P. A. Smith. Both this book and Whyburn's are practically flawless in typography. The earlier volume written by Lefschetz in the Colloquium series ("Topology," 1930) may be regarded as more or less superseded by the new work under review.

The general plan of the book by Lefschetz is roughly the following: general spaces and additive groups (Chapters 1, 2) complexes and nets of complexes (Chapters 3-6), general homology theory (Chapter 7), topology of polyhedra (Chapter 8). Both of the excellent introductory chapters will be carefully read by a very wide circle of mathematicians. In Chapter 3, the approach to the basic theory of complexes is that of A. W. Tucker. The Czech "homology theory" of topological spaces is made fundamental, of which the Alexander-Kolmogoroff, Alexandroff, Kurosch, Lefschetz and Victoris theories appear as specializations. The fundamental work of Alexander and Pontrjagin, extending the Poincaré principle of duality, and that of Lefschetz on intersections, coincidences and fixed points, is developed in the later chapters.

The reviewer has seen at least one attribution in the volume of Lefschetz which appears to him to be unsatisfactory, even if it has been widely accepted, namely calling "theorem of Zorn" (p. 5) a result which, as Lefschetz states, had been essentially given by R. L. Moore earlier.² It seems to the reviewer that the theorem would be more appropriately designated the "theorem of Moore-Zorn."

The interest in general types of spaces, important alike for algebraic and for analytic topology, began with the thesis of Fréchet (1905) in which "metric spaces" were defined and studied. Stimulated by this work and that of Hilbert and of Erhard Schmidt, E. H. Moore, the outstanding American mathematician of his day, conceived of absolutely general spaces in which the elements (points) might be of wholly arbitrary type. A little earlier he had been interested in the foundations of geometry and other logical questions. At that time there were working at Chicago with E. H. Moore a group of extremely able young men, among them Veblen, R. L. Moore and N. J. Lennes. The subsequent role of Veblen in the development of algebraic topology at Princeton has already been mentioned. R. L. Moore was destined to become the creator of the important American school in analytic topology at Austin, with G. T.

² See, for instance, his notable Colloquium volume on analytic topology, "Foundations of Point Set Theory," 1932, p. 84.

Whyburn and R. L. Wilder as outstanding students and co-workers among an important group. Veblen, R. L. Moore and Lennes had nascent ideas in the field now called analytic topology, which treats largely of connectedness and continua in topological space, where "point" and "neighborhood of a point" constitute the only primitive ideas. For example, Lennes proposed about that time to define a simple arc AB as a closed³ connected set of points containing A and B which contains no closed connected subset likewise containing A and B.

A very important later idea of R. L. Moore which finds its proper place in Whyburn's book is that of "upper semi-continuous collection." Imagine the ordinary Euclidean plane to be constituted of closed continua, U_P , one and only one containing an arbitrary point P. Suppose further that if the point P tends to a point Q, then always U_P tends toward all or a part of U_Q . The collection of sets U_P then constitutes an upper semi-continuous collection in the sense of R. L. Moore. This idea has dynamical applications as I have found, although, interestingly enough, it was invented by Moore simply as a mathematical *jeu d'esprit*, by the esthetic combination of ideas.

The general plan of the book by Whyburn is roughly the following: Introductory topology (Chapter 1), mapping theorems (Chapters 2, 8-11), theorems on connectedness (Chapters 3-6) upper semi-continuous collections (Chapter 7), periodic transformations and fixed points (Chapter 12). A considerable portion of the book is devoted to advances made by R. L. Moore and by Whyburn. Being slightly less condensed and involving a less extensive range of ideas, this book makes easier reading than that of Lefschetz.

It is significant that both volumes terminate with a discussion of "fixed point theorems." A very simple example of such a theorem is furnished by the continuous mapping of a linear segment AB of a line on part of itself, as A'B'. It is clear that as a point P travels from A to B, its image P' passes from A' to B', and coincides with or intersects P in a "fixed point" an odd (or infinite!) number of times, since P passes P' in one sense $k+1$ times and k times in the other (negative) sense. Thus we have

$$(k+1) + (-k) = 1.$$

As the Dutch mathematician L. E. J. Brouwer and others noted long ago, there is a very general type of geometric situation in which the algebraic sum of the intersection numbers (Kronecker indices) is unique and determinate, regardless of all internal details. Hence it is only necessary to make the

³ A point set is said to be "closed" if it contains all its limit points.

algebraic count of intersections in one special case to get the number of fixed points, algebraically taken. Lefschetz's well-known theorems on intersections, coincidences and fixed points describe situations belonging to this general category, of which various important special cases were previously well understood. The Appendix B by P. A. Smith with which Lefschetz's book closes is devoted to a study of the "Fixed Points of Periodic Transformations," a subject still closer to the dynamical applications. Similarly, the last chapter of Whyburn's book is entitled "Periodicity. Fixed Points," and references to the dynamical origins of this type of question are there made. Here Whyburn presents interesting work due in part to Kerékjártó, to Ayres, to Montgomery and to himself.

In this way one receives a concluding tacit suggestion in both cases that the abstract phase in the development of algebraic and analytic topology is about to pass into a second phase, less abstract and closer to basic dynamical ideas.

The significance of this rich mathematical source was realized first by Poincaré, who in the third volume of his celebrated "*Méthodes nouvelles de la Mécanique Céleste*" found it necessary to analyze the connectivity of certain manifolds of states of motion, to consider transformations and fixed point theorems and to evolve the concept of dynamical "probability." In fact it seems that *all* topological questions are presented naturally in purely dynamical contexts. Certainly there are numerous fascinating and important questions of this sort as yet unanswered. For example, questions concerning measure-preserv-

ing transformation (like rotations which preserve areas or volumes) are essentially topological in character, since these are the transformations which can not take any continua or set of continua into a part of themselves. As yet such "conservative" transformations have been little studied, although recently Oxtoby and Ulam have treated them to great advantage.

It seems to be regrettable that up to the present time so little has been accomplished by the topologists that is directly serviceable for application in the dynamical field. Since I have long worked in theoretical dynamics, on the borderland of and in what is essentially pure topology, I may be allowed to testify to this fact. More than any one else, it has been Marston Morse (see his Colloquium volume, "*The Calculus of Variations in the Large*," 1932) who has shown algebraic topology at work in the applications, through his notable "critical point relations." Likewise, as stated above, the upper semi-continuous collections of Moore in analytic topology have turned out to be valuable for the understanding of certain dynamical situations.

If further development in the direction of the applications continues, topology will indeed greatly increase in scope and significance. In any case, mathematicians generally will rely upon the books of Lefschetz and Whyburn, as representing the present high-water mark of topological development, and as furnishing first-hand and notable accounts of two basic aspects of abstract topology.

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SOCIETIES AND MEETINGS

CENTENARY OF THE AMERICAN ETHNOLOGICAL SOCIETY

THE centenary celebration of the American Ethnological Society, held on November 14, marked the founding of the oldest anthropological, and one of the oldest scientific, associations in the United States.

The society was founded in November, 1842, by Albert Gallatin, Secretary of the Treasury under Thomas Jefferson. Its headquarters have always been in New York, and it is now affiliated with the New York Academy of Sciences and the American Anthropological Association. The American Museum of Natural History in New York has consistently cooperated with the society. In 1943, the first year of the newly organized Inter-American Society for Anthropology and Geography, the society will likewise act as an affiliate and council member of that group. Membership is at present largest for the United States, but likewise includes individuals from Mexico,

Central and South America and, until December 7, 1941, from Europe, India and the South Seas. It is noteworthy that a few English members still keep their accounts active.

The celebration was originally planned to cover at least two days and to include speakers from the country as a whole, but, at the request of the Office of Defense Transportation, it was telescoped into a single meeting terminated by a dinner, and its roster of speakers was limited to the eastern seaboard from Boston to Washington.

The afternoon meeting, held at the American Museum of Natural History, consisted of three sessions on the general topic of acculturation or culture-contact, oriented toward administration. One session was devoted to each of three geographical areas: Oceania, Latin America and North America. The speakers were Ruth F. Benedict, Raymond Kennedy, Clyde Kluckhohn, Ralph Linton, Margaret Mead and

Julian H. Steward. Discussants were A. Irving Halliwell, E. Adamson Hoebel, Frank Tannenbaum, George C. Vaillant, John Whiting and A. K. Widjoatmodjo. The chairman was Wm. Duncan Strong, director of the Ethnogeographic Board. The papers will be published in full in the *American Anthropologist*.

At its centenary the American Ethnological Society passed the following resolution:

Be it resolved: that the American Ethnological Society, for 100 years dedicated to the study of peoples not belonging to Western Civilization, express upon the occasion of its centenary celebration its profound conviction that racial persecution and discrimination can not be scientifically justified. We protest the distortion of anthropology which falsely assigns inborn superiority to some one "race" and assigns others to inborn inferiority. Ethnological studies rouse enthusiasms for the inventions and social life of many peoples of all races and make it im-

possible to assent to the dogma that civilization depends upon the enslavement of one race by another.

The society was greatly honored at its centenary dinner by the presence of Albert Gallatin, great-grandson of its founder. The president, Harry Shapiro, presided. Albert Gallatin had also been instrumental in the establishment of New York University, and a congratulatory letter was read from the present chancellor of the university, Harry Washburn Chase. The society was also extremely fortunate in having as dinner speakers Clark Wissler, who served many years as secretary, president and director, and Franz Boas, who has been editor of the society's most important publication series since 1906, and to whom the society is indebted for its present organization along scientific lines.

MARIAN W. SMITH,
Secretary

COLUMBIA UNIVERSITY

REPORTS

ANNUAL REPORT OF DR. JESSUP, PRESIDENT OF THE CARNEGIE CORPORATION

DR. WALTER A. JESSUP, in his first annual report as president of the Carnegie Corporation of New York, announces that during the year 1941-42 grants totaling \$2,831,650 were voted by the trustees "for the advancement and diffusion of knowledge." Of this sum, \$533,565 was given for activities directly related to the war. The largest new grant made for war purposes, \$100,000, has enabled the Joint Army and Navy Committee on Welfare and Recreation to conduct a variety of experimental programs as a basis for the activities of the Special Service Division of the War Department. Allocations amounting to \$12,500 to the American Council on Education were made to keep colleges and universities informed of the personnel needs of defense agencies and, conversely, to inform these agencies of the manpower resources of educational institutions. Grants of \$75,000 and \$50,000 were also made to the Red Cross and the United Service Organizations, respectively, in support of their emergency activities.

President Jessup contrasts the present program of the corporation with that carried on during World War I:

The first World War came at a time when the Carnegie Corporation was hardly more than an institutionalized extension of Mr. Carnegie's personal philanthropy. Its administrative machinery was new and its program still in the making. Its direct contribution to that first great national crisis of the twentieth century took the form of generous gifts to outstanding private agencies which had undertaken to supply the amenities of life to men in the

army camps. Appropriations to other Carnegie enterprises more actively concerned in the war effort and to the National Research Council were also voted in recognition of emergency responsibilities beyond their normal resources.

The present picture differs in many essential respects from that earlier one. In the first place, the Corporation in the period since 1918 has granted \$140,800,000 to various agencies and institutions which share its concern for the advancement and diffusion of knowledge. Many of these agencies and institutions are now in a position to render direct and useful services to the Government. Secondly, the public has been educated to support the social service agencies which were the chief recipients of the grants made in 1917 and 1918, and they no longer look to the foundations for any substantial portion of their operating income. Finally, the very business of making war has changed. War now involves not only the professional soldier and the professional diplomat, but the scholar, the technician, the scientist, and the administrator as well. Success in modern war requires mobilization of all the nation's intelligence. In this kind of war, the foundation, which in the course of its normal peacetime activities has enjoyed peculiarly close relations with scientists and scholars, can play a useful role within the terms of established policies.

It has been interesting and on the whole encouraging to discover that by and large the research agencies and the professional associations which had come of age before the present war and with which the corporation has long cooperated are making substantial contributions to the war effort.

UNIVERSITY AND COLLEGE GRANTS

Over a period of years, the corporation has contributed substantial sums for the development of

libraries and for study and research in colleges and universities. During the current year, three major grants were made to the following institutions: \$150,000 to the new University Center in Atlanta, and \$100,000 each to the Johns Hopkins University and to New York University. Development grants of \$30,000 each were made to the universities of Maine and Vermont and to Colby and Southwestern (Tenn.) colleges, and a similar grant of \$25,000 was voted to the University of the South. Commenting on these grants, President Jessup says:

The war has created new problems for all American institutions, but few of them have suffered more stresses and strains than the university and the college. The budget-making of these institutions has been complicated by steady declines in enrolment. In certain fields, on the other hand, such as physics, chemistry, engineering, medicine and some of the social sciences, the difficulty of maintaining adequate teaching staffs has grown day by day. The attempt to revise regular programs to meet urgent Government demands for technically trained men has put a heavy strain on administrator and teacher alike. The skill and speed with which the colleges and universities have adjusted to all these new pressures have done much to justify the enormous investment of public and private funds which they represent. From coast to coast requests for instruction and for campus space in which to house soldiers and sailors during periods of special training have been met promptly, often at the cost of doubling already heavy teaching schedules and crowding regular students out of dormitories and fraternity houses.

For continuation of cooperative work with a selected list of graduate and undergraduate schools in developing criteria for admission and in providing a basis for judgment as to ability of those already admitted to candidacy for degrees, two grants totaling \$65,000 were made to the Carnegie Foundation for the Advancement of Teaching.

ADULT EDUCATION AND THE ARTS

In the field of adult education the corporation voted the sum of \$150,000 to the New York Academy of Medicine for the support of its services to the public and the medical profession, and \$24,000 for continuation of the program of the Council on Foreign Relations in promoting discussion and study of international problems. Grants totaling \$37,500 were made to the Canadian Association for Adult Education.

In the arts, a terminal grant of \$48,000 was made to the Association of American Colleges for its program to bring to colleges and universities in small communities some of the cultural advantages of metropolitan institutions and to provide interchange of staff members. Also grants ranging from \$2,500 to \$15,000 were made to the Universities of Alberta, Nebraska, Virginia and Wisconsin, and to Vanderbilt

University. Other grants included \$30,000 to assure continuation of a music center as a division of the Pan American Union; \$36,000 to the Metropolitan Museum of Art; and \$20,000 to the New York Museum of Science and Industry.

LIBRARIES AND RESEARCH

Since its establishment in 1911, the corporation has granted some \$30,000,000 or one sixth of its total income for library enterprises, in addition to the \$43,000,000 given by Mr. Carnegie to help establish free public and academic libraries. With few exceptions, the 2,507 libraries made possible by these grants are now supported by the local communities which they serve. President Jessup states: "Every citizen, therefore, may take pride in the part which public libraries are playing in the war effort. In addition to organizing special collections on war information and civilian defense and providing up-to-the-minute reading lists, libraries in many cities have assumed the role of community centers, registering blood donors and air raid wardens, organizing forums and discussion groups, and providing reference service by telephone and mail for hard-pressed officials and businessmen."

The major grant for library interests during the current year, \$75,000, was made to the University of Chicago Graduate Library School. Other grants included \$25,000 for the development of the library of the Marine Biological Laboratory at Woods Hole, \$10,000 in further support of the system of fellowships recently inaugurated by the Library of Congress; and a total of \$55,800 to eleven technological colleges for rounding out book collections.

For general research, the Brookings Institution received \$50,000 for support of its program, and the National Bureau of Economic Research grants totaling \$55,000 for general support and for projects relating to the national emergency.

Except for the support of enterprises in the Dominion of Canada, no appropriations are being made by the trustees from the special fund created by Mr. Carnegie for work in the British Dominions and Colonies, because of the difficulties of administering and conducting projects during the war.

THREE DECADES OF GIVING

The report concludes with an analysis of a summary, made by the secretary of the corporation, Robert M. Lester, of total grants made by the corporation since 1911. During three decades the corporation has made gifts totaling almost \$185,000,000, falling into three classifications: grants totaling more than \$70,000,000 made to agencies or enterprises established by Mr. Carnegie, or growing from them, such

as the Carnegie Institute of Technology and the Carnegie Foundation for the Advancement of Teaching; grants amounting to some \$48,000,000, made to 848

universities, colleges and schools; and grants totaling about \$50,000,000 made to 777 associations, museums, libraries and agencies for research and study.

SPECIAL ARTICLES

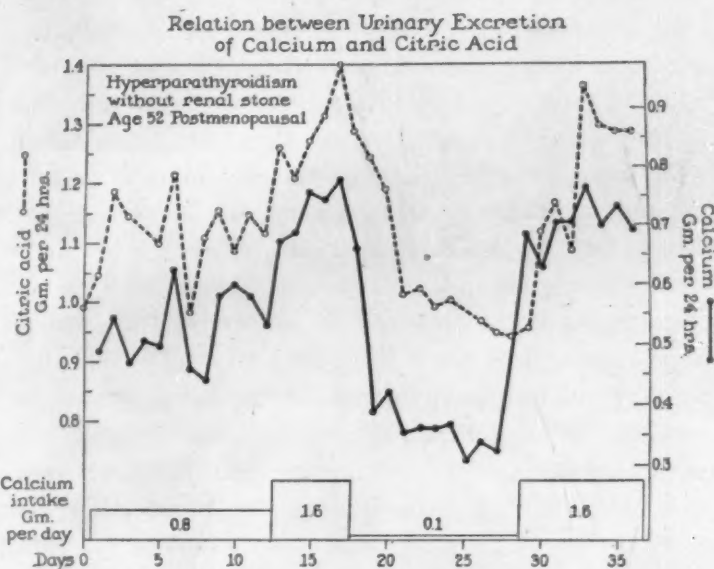
THE RELATION BETWEEN THE URINARY EXCRETION OF CITRIC ACID AND CALCIUM; ITS IMPLICATIONS FOR URINARY CALCIUM STONE FORMATION

They were most striking when sudden significant changes in urinary calcium excretion could be obtained, as in the case of hyperparathyroidism illustrated in Fig. 1. That the changes in calcium excre-

A SATISFACTORY explanation still remains to be provided for the constant appearance of considerable amounts of citric acid in urine which would relate it functionally to specific metabolic processes. Citric acid appears to be a product of endogenous metabolism; and three factors have hitherto been recognized as influencing its excretion. Alkalosis, however induced, leads to an increased output which usually varies directly with urinary pH. Excretion is also increased by the administration, best intravenously, of citrate or citric acid precursors of the dicarboxylic acid series such as succinic, fumaric and malic acids. A recent study from this laboratory¹ has shown that citric acid excretion is also under the control of the steroidal reproductive hormones. There is a characteristic cyclic alteration of urinary citrate in the different phases of the menstrual cycle; the lowest levels occur during menstruation, the highest at about the middle of the cycle; in hypogonadal subjects, estrogens elevated, androgens depressed, the urinary level. The significance of these several correlations remains obscure; in alkalosis, citrate may contribute in small measure to the buffer system of urine; and it may represent an excretion product of intermediary carbohydrate metabolism.

The purpose of the present note is to report observations on human subjects which have revealed a relationship between the urinary excretion of citric acid and calcium by virtue of which the renal excretion of citrate may serve a specific and useful function. Variations in urinary calcium excretion were induced in male subjects and in post-menopausal women by variations in the diet and, in one subject with hypoparathyroidism, by parathormone injections. Menstruating women were not included in this series to avoid the complications arising from the hormonally conditioned cyclic variations in citrate excretion characteristic of the menstrual cycle, which, from preliminary experiments, appears to be independent of the calcium factor. Parallel changes in the calcium and citrate content of the urine were uniformly observed under these conditions. The concomitant increases or decreases in both urinary constituents were of approximately the same magnitude.

¹ E. Shorr, A. R. Bernheim and H. Taussky, *SCIENCE*, 95: 2476, 606, June 12, 1942.



tion influenced the level of citrate excretion, rather than the reverse, was apparent from studies in which citrate excretion was markedly increased by the intravenous administration of sodium citrate without a significant concomitant alteration in the calcium output.

Some implications of this urinary calcium-citrate linkage may be considered briefly. The extensive literature on the influence of the citrate ion on calcium is in general agreement that, at alkaline pHs, the presence of the citrate ion enhances the solubility of the calcium by the formation of a soluble negatively charged calcium-citrate complex and a reduction in the concentration of calcium ions.² On the acid side also, the presence of the citrate ion results in citrate complexes which are favorable to a greater total solubility of calcium.

These considerations have already influenced thinking with respect to the formation and solution of calcium stones of the urinary tract. A citric acid-sodium citrate mixture has been employed with some success for the solution, by lavage, of calcium phosphate stones in the urinary tract.³ A low citrate excretion has been reported in subjects with renal and bladder calculi,⁴ although the factor of infection

² F. C. McLean, *Physiol. Rev.*, 18: 495, 1938.

³ F. Albright, H. W. Sulkowitch and R. Chute, *Jour. Am. Med. Assn.*, 113: 23, 2049, December 2, 1939.

⁴ B. Kissin and M. O. Locks, *Proc. Soc. Exp. Biol. and Med.*, 46: 216, 1941.

which would reduce citrate content by bacterial action was apparently not eliminated. Finally, a higher than normal excretion of calcium has been reported in a high percentage of patients with urinary calculi, a condition which might be expected to favor calcium precipitation.⁵

The present studies provide positive evidence for the existence of a renal mechanism by which the normal kidney can adjust the urinary excretion of citrate to the urinary output of calcium, and so alter the composition of the urine as to favor calcium solubility and, conversely, prevent stone formation. Suggestive evidence in support of this view-point was provided by two male subjects with uninfected urines, with a history of several recurrences of calcific renal stones, who were studied in a stone-free interval. Both showed a similar derangement of calcium-citrate metabolism on low calcium diets. Although the negative calcium balance fell within the normal range, abnormally large amounts of calcium were excreted in the urine and very little in the stool. The high urinary calcium output was accompanied by an unusually low content of citric acid as compared with normal subjects. One subject with bilateral renal calculi associated with hyperparathyroidism and a high urinary calcium, excreted abnormally small amounts of citrate even when urinary tract infection was largely controlled with sulfadiazine. On the other hand, the subject with hyperparathyroidism illustrated in Fig. 1, whose hypercalcaemia was always associated with a high citrate excretion, has remained free of renal calculi over a period of almost two years of observation.

On the basis of these observations it is tentatively suggested that an impairment of the mechanism by which the kidney adjusts citric acid excretion to the urinary calcium output may be involved in the production of metabolic calcium urinary calculi by providing an environment favorable to the precipitation of calcium stones. In some patients with renal stones, this derangement is also accompanied by an unusually high urinary excretion of calcium, providing an even more favorable environment for stone formation. The factor of infection can further predispose towards stone formation by reducing the citrate content of the urine through bacterial action. Whether this postulated renal function operates through variations in citrate resorption or citrate production from precursors is now under investigation.

This concept provides a rational basis for a therapeutic regime designed to compensate for an impairment in the renal citric acid mechanism. Studies now in progress indicate that it is possible to increase urinary citrate excretion significantly without increas-

ing the calcium output, by feeding various citric acid precursors of the C₄-dicarboxylic acid series. This procedure is free from certain theoretical and practical disadvantages attendant on the prolonged administration of alkalis or estrogens, which also increase urinary citrates.¹ A therapeutic regime of this character may be expected to help prevent recurrences of renal calculi and aid in the solution of those already present, as well as reduce the incidence of renal stones in the immobilized fracture case with hypercalcaemia.

The technical assistance of Miss Maria Chianti is gratefully acknowledged.

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NEGATIVE WATER BALANCES DURING EXPOSURES TO LOW BAROMETRIC PRESSURES

RATS exposed to pressures of 380 mm Hg lose weight rapidly in comparison with rats kept at 760 mm Hg pressure but otherwise under identical conditions (fasted, water *ad lib*). When the composition of this weight loss was examined, it was found that the increased weight loss of the experimental animals was due to an increase in insensible water loss without a concomitant thirst. Table 1 shows typical results: 8 rats in each group were exposed for 6 hours to the noted pressures. The differences between the averages of the two groups with respect to loss of feces and urine and to water drunk are insignificant. But the insensible water loss (as measured by appropriate absorption methods) is doubled for the animals exposed to low pressures. From these measurements, a considerable negative water balance is evident. In spite of this loss of water from the organism, it should be emphasized, the water intake is not increased. The same phenomenon, with its apparent lack of compensating thirst, has been found to occur during exposures of 12, 18 and 23 hours.

TABLE 1

	Initial weight g	Weight loss g/100g	Feces g/100g	Urine cc/100g	Water drunk cc/100g	Insensible water loss cc/100g	Water balance cc/100g
760	164.2	4.8	0.4	1.0	0.5	2.5	-3.0
380	154.1	6.7	0.9	1.7	0.7	4.9	-5.9

Of the many factors operative at high altitudes which might be responsible for this negative water balance, anoxia appears to be the main causative factor. This is indicated by the two following experimentally established facts: first, the phenomenon is

⁵ R. H. Flocks, *Jour. Am. Med. Assn.*, 113: 16, 1466, October 14, 1939.

prevented by giving oxygen instead of air to breathe, at pressures of 380 and 190 mm Hg; and, second, the phenomenon occurs when the rats are given, at 760 mm Hg pressure, a mixture of 10½ per cent. O₂ and 89½ per cent. N₂ to breathe. These two experiments also show that pressure changes *per se* are not responsible for the negative water balances. Furthermore, it is probable that anoxia causes the phenomenon because of the hyperventilation which it induces. When rats were made to hyperventilate by giving them gas mixtures high in CO₂, keeping the O₂ constant at 21 per cent., a negative water balance of considerable magnitude is induced. Thus, with 5 per cent. CO₂, it was 5.1 cc per 100 gms of rat; with 10 per cent. CO₂, 4.7 cc and with 15 per cent. CO₂, 5.2 cc. These figures approach, but do not quite reach, the negative water balance of exposure to 380 mm Hg pressure (5.9 cc; see Table 1). Hyperventilation in effect passes more air over the evaporating surface of the lung and there results a greater water loss.

We feel that this negative water balance may be of importance in the etiology of pilot fatigue. The latter is postulated by Armstrong¹ to be closely related to adrenocortical insufficiency. In our opinion,

the chain of events leading to this insufficiency is as follows: first, a water loss, as demonstrated here, and, second, a renal salt loss, due to the previous water loss² and to the relative alkalosis of acapnia.^{3,4} Such a salt loss has been shown to occur in mountain climbers^{5,6} and during exposures to low oxygen tensions.⁷ It appears to be in some way mediated by the adrenal cortex.⁷ The combined salt and water loss, unaccompanied by thirst, puts a considerable strain on the adrenals; if repetitive, it would tend to produce a subacute adrenocortical insufficiency. McCance⁸ has described a somewhat similar situation in which great loss of body salt and water was unaccompanied by thirst. This resulted, in his experiment, in a condition simulating adrenal insufficiency and in a train of symptoms startlingly like those of pilot fatigue.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

DETERGENTS AND STAINING OF BACTERIA

In order to obtain a satisfactory microscopic preparation of bacteria, in which cells are uniformly distributed, it is necessary to have slides which are thoroughly cleansed by chemical methods, flaming, or both. Otherwise, the high surface tension caused by the presence of fat-like substances on the surface of the slides produces an uneven and massed distribution of the bacteria.

In course of the routine laboratory work it has been found that satisfactory preparations could be made on slides which were cleaned mechanically from the dust particles with a piece of cloth, if to the suspension of the bacteria a small amount of a detergent was added. The following procedure gave satisfactory results.

Water solutions of "Aerosol OT" or a saline solution of "Aerosol MA"¹ 1:500 were kept at hand. One loopful of one of those dilutions was placed with a loop on the slide. Bacteria were added from the liquid or solid media to this drop of detergent and the suspension was spread uniformly over the desired area with the loop. Preparations were air dried without heating, fixed with methyl alcohol or heat, and

stained in the usual way. No detrimental effect of the presence of the detergent on the quality of the staining was noticed.

It was also found that the preparations made for the staining of the flagella gave the same results on the slides which were cleansed mechanically and the bacteria were suspended in distilled water containing "Aerosol OT" in the dilution 1:1000, as on the slides which were cleansed chemically and flamed with the bacteria suspended in distilled water alone. The quality of the flagella preparations was still better, however, when washed and flamed slides were used and the bacteria were suspended in the "Aerosol OT" solution. In such preparations the distribution of bacteria on the slides and the arrangement of the flagella were found most satisfactory.

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DEPARTMENT OF BACTERIOLOGY AND
BIOCHEMISTRY,
UNIVERSITY OF MAINE

² J. P. Peters, "Body Water," Springfield, Ill., 1935.

³ Y. Henderson, *SCIENCE*, 49: 431, 1910.

⁴ E. J. Van Liere, "Anoxia, Its Effect on the Body," Chicago, 1942.

⁵ G. Von Wendt, *Skand. Arch. f. Physiol.*, 24: 247, 1910.

⁶ E. S. Sundstroem, *Univ. of Calif. Publ. in Physiol.*, 5: 121, 1919.

⁷ R. A. Lewis, G. W. Thorn, G. F. Koepf and S. S. Dorrance, *Jour. Clin. Invest.*, 21: 33, 1942.

⁸ R. A. McCance, *Lancet*, 1: 823, 1936.

¹ H. G. Armstrong, "Aviation Medicine," Baltimore, 1939.

¹ Samples were kindly supplied by the American Cyanamid and Chemical Corporation.

A GRAVITY WRITING LEVER FOR RESPIRATORY TAMBOURS

THE superiority of tambours with gravity writing levers is quite apparent to all who have supervised laboratories in pharmacology or physiology. We have found a very simple and inexpensive modification of the Marey tambour to be a satisfactory substitute for the more expensive instruments now on the market.

The principle of the gravity writing arm is secured by making a simple carrier into which is fitted the ordinary writing arm in such a manner that gravity will hold it in contact with the drum. This carrier is made from a piece of 30-gauge metal (we use aluminum) about $1\frac{1}{2}$ inches square, plus about 3 inches of 18-gauge

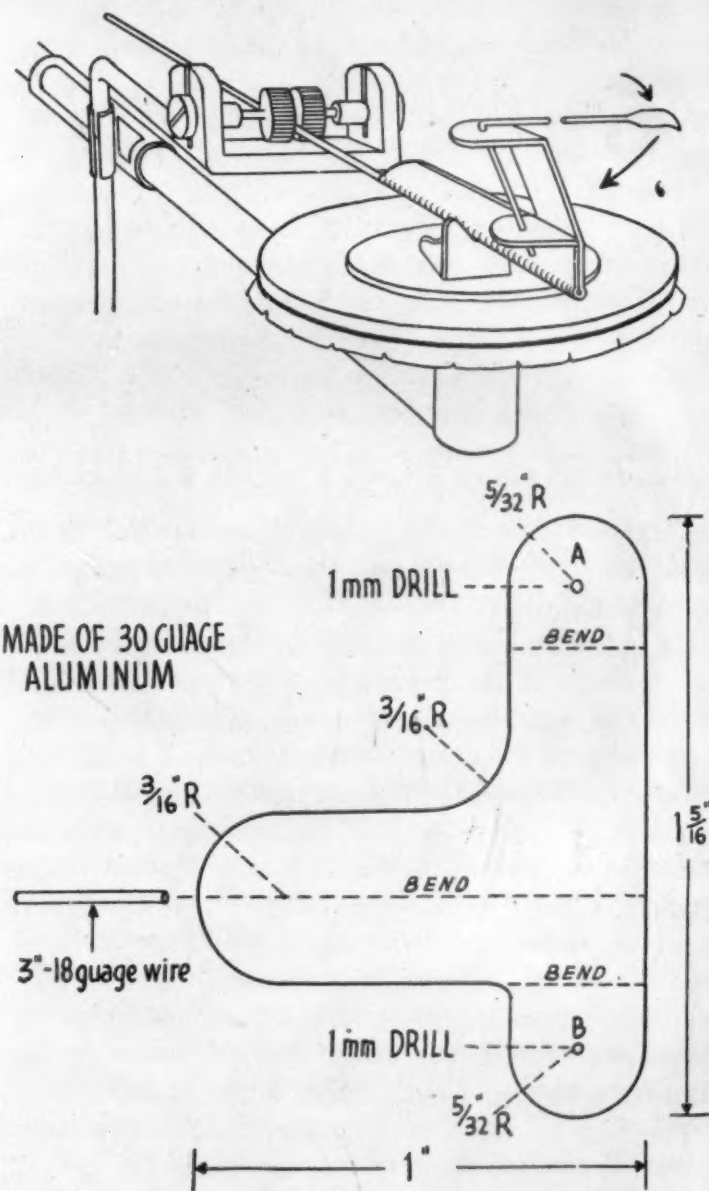


FIG. 1

wire. The figure shows the pattern for the carrier. The metal when thus shaped is folded over one end of the 18-gauge wire and crimped so as to hold. The wire is then placed in the spindle in the same manner as the old lever wire. The old writing arm is cut to the desired length and about one-half inch bent to nearly a right angle. The short arm of this right angle is inserted in the holes A and B, as shown in

the figure. To adjust the swing of the arm to gravity it is only necessary to tilt the carrier a little toward the face of the drum. The pressure on the drum may be varied by the amount of tilt given the carrier and by increasing or decreasing the weight of the writing arm.

This slight modification of our stock of Marey tambours has enabled us to salvage a large number of them at a cost of but a few cents each, and at the same time obtain practically all the advantages of expensive tambours equipped with gravity writing levers.

HAROLD R. HULPIEU
RALPH C. WELCH

DEPARTMENT OF BIOCHEMISTRY AND PHARMACOLOGY,
INDIANA UNIVERSITY SCHOOL OF MEDICINE,
INDIANAPOLIS, INDIANA

A FURTHER IMPROVEMENT IN THE HARVARD KYMOGRAPH

SUPPLEMENTING the three improvements in the Harvard kymograph already described,¹ the writer has made one change which has definitely improved the kymograph drum and solved the problem of cutting off the paper.

The aluminum drums of the Harvard kymographs become badly scratched by instruments used for cutting the paper until the surfaces are no longer smooth enough for careful work. The drums may be turned down on a metal lathe until they are perfectly smooth again and while still in the lathe a narrow, shallow groove may be cut across the drum directly opposite one of the four spokes just deep enough to take a few strands of thin copper wire. A hole is then drilled one half inch from the groove into the spoke at both ends of the drum with a number 35 drill, the hole tapped with a 6×32 tap and a set screw one quarter inch long inserted into each hole. The wire is fastened securely to the bottom set screw and the other end of the wire is wrapped around the top set screw. Attach the paper and smoke in the usual manner. After a record is made the wire is loosened from the top screw and pulled out and down with one hand, while holding the cut ends of the paper with the other hand. In order to avoid cutting through the record paste the two ends of the paper directly above the wire and start recording just beyond that point.

THE UNIVERSITY OF TOLEDO
ARCHIE N. SOLBERG
¹ H. B. McGlade, *SCIENCE*, 91: 412, 1940.

BOOKS RECEIVED

- ARMSTRONG, E. A. *Bird Display*. Illustrated. Pp. xvi + 381. Macmillan. \$5.50.
FRY, CLEMENTS C. and EDNA G. ROSTOW. *Mental Health in College*. Pp. xix + 365. Commonwealth Fund. \$2.00.
POLLARD, ERNEST and WILLIAM L. DAVIDSON, JR. *Applied Nuclear Physics*. Illustrated. Pp. vii + 249. John Wiley & Sons. \$3.00.
Reports of the Biochemical Research Foundation of the Franklin Institute. Illustrated.

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SCIENCE NEWS

Science Service, Washington, D. C.

AN ULTRA-FAST OSCILLOGRAPH

A BEAM of electrons sweeping back and forth across a photographic film at speeds up to 18,000 miles per second, a tenth that of light, times a lightning flash to a few billionths of a second, measures the current and voltages, and draws a picture of the oscillations. This is the ultra-fast oscillograph described by E. J. Wade, T. J. Carpenter and D. D. MacCarthy, all of the General Electric Company, Pittsfield, Mass., in a paper presented at the Chicago meeting of the American Institute of Electrical Engineers.

The instrument was developed for research on lightning arresters to determine the duration, intensity and character of the electric surges that occur when the arrester is struck by lightning. Artificial lightning was used. One film showed a flash which died away in about a ten-millionth of a second. During that time, however, 11.3 oscillations occurred. Thus the electron beam swept back and forth this number of times across the film or at the rate of 113 million times a second, and attained a maximum "writing speed" of 18,000 miles a second.

The instrument, a veritable time-microscope, can of course be used in any other cases where "transients" or electrical actions of exceedingly short duration are involved. The ordinary oscillograph is used in television, in determining the wave forms of alternating currents and in many electronic devices. It has even been used in geophysical prospecting for oil.

THE ELECTRIC INDUCTION MOTOR AT WRIGHT FIELD

A 40,000-horsepower electric induction motor drives air through the great wind tunnel at Wright Field. It is part of a large group of powerful machines required for the proper operation of the tunnel. Among these are a 38,000-horsepower motor-generator set, another of around 8,000 horsepower, a 400-horsepower exciter set, 6,900-volt and 460-volt switch gear, great cooling fans, oil circulation pumps, electronic control apparatus and other instruments.

The fine speed regulation of the great motor, the harmonious coordination and control of all the rest of the machinery and safety of operation were discussed by Robert R. Longwell and M. E. Reagan, of the Westinghouse Electric and Manufacturing Company of East Pittsburgh, Pa., at the Chicago meeting of the American Institute of Electrical Engineers. The operation and control are as far as possible automatic. A few manual operations are required to start the auxiliary machinery. When this is smoothly running, the operator merely sets a pointer on a dial to the desired speed. Automatically the oil pumps are started, switches are thrown, control apparatus brought into play, and the great motor is brought gradually and smoothly up to the desired speed and then held there by electronic control. To change the speed, the operator simply moves the pointer up or down. To stop the motor, he moves the pointer back to zero.

During an airplane test, the speed is maintained constant to within 0.3 per cent. to 0.5 per cent.

One reason for describing this installation was that the same principles can be applied wherever large powers must be very accurately controlled, or many machines must be coordinated to do their proper tasks at the proper times.

1,000,000-VOLT X-RAY UNITS

THAT more than 40 of the compact 1,000,000-volt x-ray units recently developed are now in operation in industrial plants, or soon will be, as against only one a year ago, was reported to the Atlantic City meeting of the American Society for Testing Materials by Dr. Ernest E. Charlton, head of the x-ray division of the General Electric Research Laboratory. His associate, W. F. Westendorp, collaborated in the preparation of the paper.

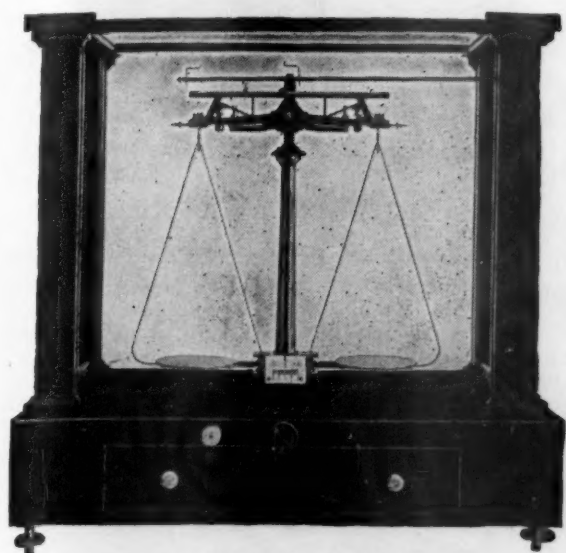
These units, each a complete outfit including the transformer and completely shielded, are three feet in diameter, four feet high and weigh 1,500 pounds. They are portable in the sense that they can be lifted about by a crane and transported to any part of a plant where their services are needed. Previous 1,000,000-volt units were big as a house and necessarily fixed in position. In a hospital this was no insurmountable obstacle. The patients could easily be brought to the machine. But in an industrial plant, where the "patients" are masses of steel weighing many tons, this is impossible. The machine must be brought to the patient.

Two things were principally responsible for making the light-weight unit possible. First, the resonance transformer developed by Mr. Westendorp, which dispensed with the heavy iron core usually employed. Second, the substitution of 40 pounds of Freon gas for 5 tons of oil as insulating material. But a portable outfit for industrial use would still have been impossible without the device of putting the transformer inside the unit, thus avoiding any external high tension wires. This is the resonance transformer which jacks the voltage up to a million and immediately lets it down through the tube—which is in the center of the coil where the iron core would ordinarily be—in 12 easy stages of about 85,000 volts each.

Million-volt x-rays can penetrate 8 inches of steel and in a few minutes make a picture which otherwise would require hours or even be impossible. These new portable and safe units will not only speed up war production, but will make the material turned out safe for use of our armed forces. Some of them have been in use for nearly a year and have shown no sign of deterioration.

EXTENSION OF THE SPECTRUM

A NEW "window" in the atmosphere has been discovered by Dr. Arthur Adel, of Lowell Observatory, at Flagstaff, Ariz. To the American Astronomical Society, he has reported the extension of the observable spectrum in the infrared region from wave-lengths 14 μ (one



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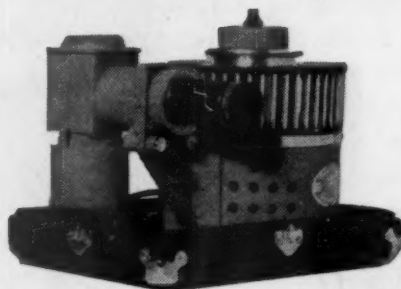
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m μ is a millimicron or a millionth of a millimeter) to 24 m μ , or nearly a whole octave.

Until recently, the long wave-length limit for which we could observe the spectrum of the sun was 14 m μ . In July, 1941, Dr. Adel discovered a new spectral region of atmospheric transparency which allowed the obtaining of the sun's spectrum down to 24 m μ . This discovery concluded a search he had begun in 1935.

Because of its high density, the atmosphere effectively absorbs great quantities of the light and energy we receive from the sun and the stars. In some cases it does this selectively, that is, for just certain wave-lengths of the incoming light. The absorption is accomplished by nitrogen, oxygen, water vapor and carbon dioxide. The bands of water vapor and carbon dioxide are particularly strong in the infrared region of the spectrum; however, Dr. Adel has pierced this "fog" in at least this one region.

In addition to revealing hitherto unknown portions of the solar and terrestrial spectra, the discovery is important in connection with the problem of the radiation of the earth into space and the reception of long-wave radiation from the cooler planets, Jupiter, Saturn, Uranus and Neptune.

The potassium bromide prism used by Dr. Adel in his investigation was furnished by Dr. C. G. Abbot, secretary of the Smithsonian Institution, of Washington, D. C.

THE ELECTRON MICROSCOPE USED AS A DIFFRACTION CAMERA

J. HILLIER, R. F. Baker and Dr. V. K. Zworykin, of the Research Laboratories of the RCA Manufacturing Company, Camden, N. J., reported to the American Physical Society meeting at Pennsylvania State College that the electron microscope can now not only make an enormously magnified picture of a minute object, but also determine its molecular structure. You can not see the atoms but you can find out where they are. This of course could be done before by means of another instrument, the diffraction camera, using either x-rays or electrons. But now an "adapter," applied to the standard commercial electron microscope, quickly converts it to a diffraction camera, thus dispensing with the second instrument and with a second source of radiation.

Within a few minutes of each other a picture and a diffraction pattern of the same specimen can be made without remounting it, without removing it from the vacuum, and without tampering with it in any other way. In many fields of investigation this is a great advantage.

To pass from microscope to diffraction camera, it is only necessary to shift the position of the specimen in the tube, which is done by gadgets on the outside, and to change the lens. The latter is easy. An electron lens is merely a coil of wire in which an electric current is flowing. When the current stops, it ceases to be a lens. Hence, to switch from the projection lens which makes the picture to the lens which produces the diffraction pattern, it is only necessary to switch the current from one to the other.

The instrument is so arranged that diffraction patterns can be made either by transmitted light or (for opaque objects) by reflected light. For the latter the specimen

is turned so that the electrons are reflected at a grazing angle. Provision is also made for rotating the specimen in its own plane, which is useful in making diffraction patterns. The diffraction pattern produced in this way is a set of concentric circles, some sharp, some diffuse. From dimensions and intensities, the arrangement of the atoms in the material can be determined.

ALEUTIAN WEATHER

ALEUTIAN ISLAND weather is fully as bad as Navy men say it is, examination of published records of the U. S. Weather Bureau shows. It's the kind of thing we hear about Iceland—plus.

It must be one of the drizzliest places on earth. The observatory on Attu, one of the islands reported seized by Japan, shows a mean annual rainfall of about 71 inches, which is not at all terrific so far as total precipitation goes. Annual rainfall along the Atlantic coast near Washington runs about 50 inches. But the total number of days on which measurable rainfall occurred was 200 out of the 365. That means an endless procession of little rains. And it doesn't count heavily cloudy days on which no rain occurred; neither does it count fogs that put no water in the rain gauge.

It never gets very cold in the Aleutians—and it never gets warm. Zero Fahrenheit has never been reported; the thermometer in winter hovers constantly near freezing point, but seldom dips below it. Summer temperatures average a trifle under 60 degrees, and rise to near 70 so seldom that such days don't figure in tabulation of averages.

While frosts have been recorded during every month except July, they are uncommon in summer. The frost-free season extends from late May until early October. According to the Weather Bureau, it gives a growing season actually longer than that of some of the northern states. "However, owing to the large amount of cloudiness and the comparatively low summer temperatures, vegetation, except native grasses, makes slow growth, and gardens are not much of a success." Orchards and forests would be even less of a success, apparently; the natural vegetation of the islands includes no tree species whatever.

The climate of the islands, however dull, is not without its exciting spells of weather. Cold water of the Bering Sea on one side, warm water brought up from subtropical Pacific areas by the Japan current on the other, set up contrasts that breed all manner of storms. Many of the cyclonic disturbances that sweep down across North America originate here, or take on their characteristics after emerging as "young" storms from Siberia across the way. There are also the notorious local "williwaws," violent windstorms in which the air currents seem to blow "every-which-way."—FRANK THONE.

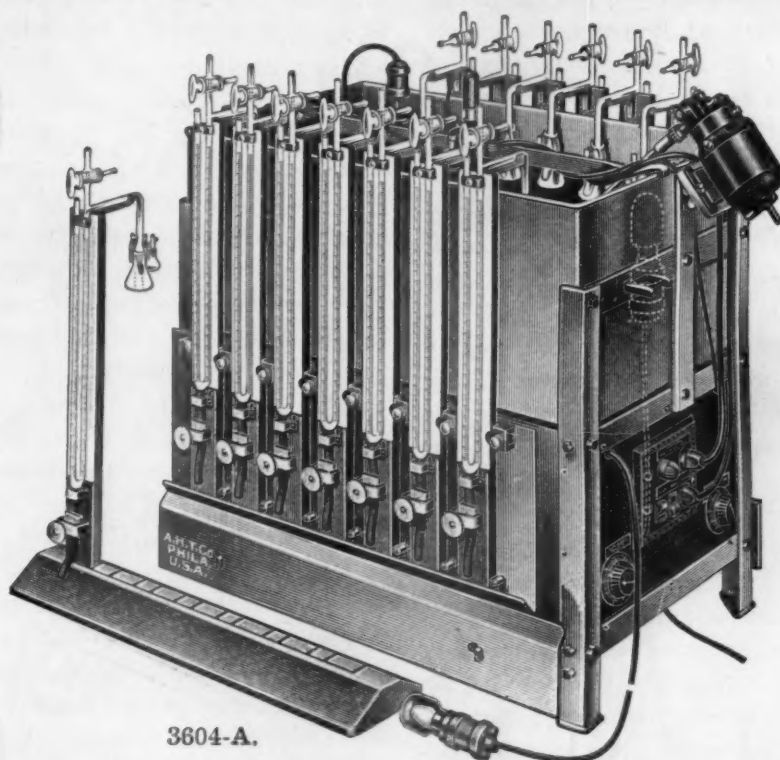
ITEMS

LITHIUM, third lightest element, has been identified in at least 19 stars by Drs. A. McKellar and W. H. Stillwell, astronomers at the Dominion Astrophysical Observatory, Victoria, B. C. Their results were reported to the members of the American Astronomical Society meeting at New Haven. Hitherto, lithium had been found defi-

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nitely present in only one star, WZ Cassiopeiae. This is an N-type star, often called "red carbon stars," and one of the coolest known, but there are a few score of other N-type stars which did not appear to contain lithium in their atmospheres. However, the astronomical chemist is constantly improving his technique, particularly by using spectrographs attached to large reflecting telescopes, such as the 72-inch at Victoria, one of the world's largest instruments. With a grating spectrograph, Drs. McKellar and Stillwell studied the spectra of 19 red carbon stars and detected the presence of lithium in all but one of them. The existence of lithium in almost all stars is indicated by this work, but their high temperatures prevent its spectral lines from showing.

STAR "shells" are made of the same elements as the stars themselves, according to Dr. D. H. Menzel and L. H. Aller, of the Harvard Observatory. They find that the planetary nebulae, which are great clouds of gas surrounding the very hot O-type stars, are composed chiefly of hydrogen, helium, carbon, nitrogen and oxygen. These are the same five elements which play the important role of furnacemen in the sun and most other stars. In the well-established carbon cycle, originally proposed by Dr. Hans Bethe, of Cornell University, hydrogen is the fuel and helium the ash of stars, while carbon, nitrogen and oxygen are the elements which keep the process going. Dr. Menzel and Mr. Aller obtained their results, as reported to the American Astronomical Society, from a study of "enhanced" and "forbidden" lines in the spectra of the planetaries. The new findings confirm the belief of astronomers that the same proportion of elements makes up all things in the universe.

A NEW "mar" test has been devised to indicate how well the transparent plastics used for the gun turrets, nose pieces and windows of our airplanes will resist the dulling effects of dust, smoke and sand blown against them with great force. The ordinary scratch and hardness tests have been found unreliable indicators of this effect. The new test, which is much more direct, was described by Ladislav Boor, physicist of the Stamford Research Laboratories of the American Cyanamid Company, at the meeting in Atlantic City of the American Society for Testing Materials. The test consists in allowing a stream of finely divided carborundum to fall from a height of 25 inches on the test piece, which is inclined at an angle. A definite amount of the abrasive is allowed to fall, producing a dulled spot. The loss of gloss as compared with the original gloss is then measured with a glossmeter. This is an instrument used to measure the glossiness of paint and of other surfaces. Several materials were tested in this way giving ratings quite different from those obtained by the scratch and hardness tests, but no one final method was decided upon.

A NEW sulfa drug has been announced by Sharp and Dohme. It is succinyl sulfathiazole, which the firm has released under the trade name, Sulfasuzidine. Studies in the laboratory and with patients have shown that it is active against dysentery and other intestinal tract germs and may therefore be effective in preventing infection following operations within the abdomen. It is also claimed that it cures carriers of dysentery germs.

THE sulfa drugs are saving 75 out of every 100 patients stricken with influenzal meningitis and about 90 out of every 100 with meningococcus meningitis, according to two surveys reported to the *Journal* of the American Medical Association. Before the introduction of the sulfa drugs, the mortality from influenzal meningitis was 100 per cent. among patients most of whom, 74.6 per cent., were babies and children under 6 years old. When sulfanilamide was used to treat this deadly disease the mortality was reduced a little, to 92.3 per cent., but after sulfapyridine became available, the mortality dropped to 25 per cent. among patients. These figures apply to experience at the Los Angeles County Hospital and are reported by Dr. Evelynne G. Knouf, of Los Angeles; Dr. William J. Mitchell, of Alhambra, Calif., and Dr. Paul M. Hamilton, of San Marino, Calif. Dr. Horace L. Hodes and Captain Paul S. Strong, U. S. Army, report that for the other kind of meningitis, sulfa drug treatment saved 98 out of 110 patients, a mortality of 10.9 per cent., at Sydenham Hospital, Baltimore, between January, 1938, and February, 1942. Sulfathiazole and sulfadiazine, they find, are superior to sulfanilamide in treatment of this kind of meningitis.

PROFESSOR R. A. GORTNER, of the University of Minnesota, speaking before the American Association of Cereal Chemists, pointed out, in the course of his Osborne Medal Award address, that in the earliest days of food analysis chemists thought that plant and animal substances of any general class were identical. They spoke of an "animal principle" in plants—meaning plant protein. Further research showed, however, that the two classes were distinct, and that there were many kinds of plant proteins. The more powerful and exact the instruments used in research, the more the discovered differences have multiplied. Newest results, obtained with the two newest methods of separation (ultracentrifuge and electrophoresis) have shown that even special proteins, hitherto considered uniform, simple substances, have within themselves further structural differentiations. Furthermore, these differences, though apparently insignificant at first sight, have far-reaching effects both in food-processing techniques and nutritional value of the products.

THE newest bond between North and South America is the publication, starting with the current (June) issue, of the *Annals of Surgery* in Spanish. This fifty-seven-year-old publication is the official organ of the American Surgical Association and the Southern Surgical Association. The new Spanish edition will be published in Buenos Aires, Argentina, by the Guillermo Kraft Company. The edition in English will continue to be published by J. B. Lippincott Company. "The policy of the journal has been formulated by a distinguished editorial board representing the medical schools and the national surgical societies of the United States and Canada. In the future," according to Dr. Walter Estell Lee, chairman, "this board will sincerely hope to secure the support, inspiration and privilege of consulting members from our sister republics in South America, where surgical work of such a high caliber is being performed."

McGraw-Hill Books of Unusual Interest

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In revising this well-known text, which has been a standard for over 20 years, the authors have included much new material in order to bring the book completely up to date with regard to life histories, habits, control methods, etc. Many chapters have been entirely rewritten, and the material of others rearranged to show more nearly the latest ideas on those subjects. The newer insecticides are discussed, and special attention has been given present-day control methods.

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SCIENCE NEWS

Science Service, Washington, D. C.

ATOMIC FISSION

ATOMIC fission similar to that of uranium 235, on which hopes of atomic power on this earth are based, takes place in the sun's corona, that system of luminous streamers that surrounds the sun and is visible only at a total solar eclipse. This is the theory proposed by the eminent Indian scientist M. N. Saha, University College of Science, Calcutta, in a letter to *Nature*.

The cracked atoms, stripped of many of their outer electrons, originate, according to the theory, in the layers below the corona and are hurled outward with terrific velocities. As they travel they knock out electrons right and left from the atoms they encounter, themselves alternately gaining and losing electrons as often as a thousand times in one centimeter (about 0.4 of an inch) of travel. Loss of energy through the frequent collisions finally brings the streaking fragments to a halt.

This theory accounts for a number of things hitherto obscure. The outer corona is generally believed to consist entirely of free electrons. But the origin of these electrons was never until now adequately accounted for. Mysterious "forbidden" lines have been observed in the spectrum of the corona. Many of these lines were found to be due to atoms of iron, nickel and calcium that had been stripped of many of their outer electrons. This discovery of Grotrian and Edlen, which Dr. Saha confirmed, was thought to complicate the theory of the solar corona. But it fits right into Dr. Saha's theory.

His idea is that these atoms are the result of a cracking process like the fissions of uranium, thorium and proactinium, which have been carried out on the earth. The idea is supported by recent experiments at Professor Bohr's laboratory at Copenhagen by Boeggild, Lauritsen and others. The experimenters found that fission fragments are hurled apart with velocities of about 9,000 miles per second, 1/20 that of light, which are greater than the velocities of the outer electrons in their orbits. Consequently these electrons are left behind and the fission fragments become highly stripped atoms. It is as though the sun should be suddenly whisked away, leaving its planets behind.

The forbidden lines observed in the sun's corona, forbidden because they do not occur under ordinary earthly conditions, are broad. This broadness indicates a velocity of about 60 kilometers (36 miles) per second. This is the velocity, Dr. Saha says, which they have slowed down to by the time they get far enough out into the corona for their lines to be observed.

METALLURGICAL STUDIES WITH THE ELECTRON MICROSCOPE

ELECTRON microscope pictures transmitted by television may be one of the future uses of a new scanning microscope now, however, devoted to metallurgical studies for the war industries.

The new instrument was described by Dr. V. K. Zworykin, associate director of the RCA Laboratories, in

a paper read at the Institute of Radio Engineers meeting at Cleveland. Dr. James Hillier and Richard L. Snyder, also of the RCA Laboratories, collaborated in the development of the instrument. The scanning electron microscope, developed over a period of years, combines the electron microscope, television and radio facsimile. It permits study of the grain structure of opaque objects, such as metals, to an order of minute detail never before realized. According to Dr. Zworykin, the full range of its possible uses can not be judged at this time.

In the ordinary electron microscope, the electron beam, like the light in an optical instrument, throws an image of all parts of the object simultaneously on the fluorescent screen. In the scanning instrument, the beam is narrowed down to a spot no more than 1/2,000,000 inch (100 Angstrom units) in diameter—about 1/1,000 the size of a pin point. This tiny spot sweeps back and forth over the specimen, itself only a fraction of an inch in size, scanning it as in a television transmitter, and builds up the image on the fluorescent screen in successive parts. Great difficulties were encountered in obtaining and handling this sub-microscopic spot. In the present arrangement, the light from the fluorescent image, now ordinary light, is concentrated by an optical lens on the photo-cathode of an electron multiplier which in turn operates a facsimile printer. This form is adapted to metallurgical studies.

At the recent meeting of the American Physical Society at Pennsylvania State College, Hillier, R. F. Baker and Zworykin announced another major improvement in electron microscopes, an adapter by which the conventional instrument can be quickly converted into a diffraction camera to reveal the molecular structure of a specimen, without interfering with the normal operation of the instrument as a microscope.

FOAM GLASS

BREAKING a bottle-neck caused by the shortage of cork, a new kind of glass that floats on water is about to be used in life preservers, life rafts and life boats. It is a black, non-transparent material that does not at all look like ordinary glass. Weighing only 10 pounds per cubic foot, Foamglas, as it has been named, is being produced in a large factory in western Pennsylvania by the Pittsburgh Corning Corporation.

The new floating glass has a cellular structure but each tiny cell is airtight. For that reason the material is permanently buoyant in water and has high insulating value. It is rigid rather than resilient, and can be sawed or drilled with ordinary tools.

It is expected to serve in place of such scarce imported materials as balsa wood, cellular rubber and kapok as well as cork. Foamglas has the added advantages of being odorless, fireproof and vermin-proof. This light-weight glass is made by a process that resembles the way in which yeast or baking powder raises bread. Ordinary glass is mixed with a small quantity of pure carbon.

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In revision "AN INTRODUCTION TO MATERIA MEDICA AND PHARMACOLOGY" for the new third edition, the authors followed suggestions and criticisms offered by users of previous editions. Changes have been made in almost every chapter, and all unnecessary detail has been eliminated so that the material is concise, the size of the text convenient.

Most important, the material has been rearranged to conform to a **UNIT PLAN OF TEACHING**. Drugs are grouped together in units, according to ailments, providing for the study of drugs in relation to disease conditions for which they are given. For this reason some chapters on chemistry of compounds have been entirely omitted or incorporated into other chapters on related subject material.

New drugs are discussed, and new material, both illustrative and textual, has been added. The sulfonamide drugs are stressed as a group. The chapter on the all-important subject of "Arithmetic Review" has been consid-

erably revised. Suggestions for laboratory work have been added and easier ways of computing dosage given. Quite a few new illustrations have been added to the chapter on "Administration of Medicines" and the chapter on "Action of Drugs; Dosage" has been brought completely up to date.

Comparing "AN INTRODUCTION TO MATERIA MEDICA AND PHARMACOLOGY" with other texts on the subject, you will find that it does not presuppose a basic knowledge of anatomy and physiology, but gives a thorough scientific background. Also, drug action is taken up, more carefully and completely than in some other texts.

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When the glass is heated to a certain point it softens and the carbon combines to form a gas that puffs up the molten mass to one-fifteenth the weight of ordinary glass. Exact time and temperature control is necessary to obtain rigid vitreous slabs with cells uniformly small and sealed one from another.

Since 1938 this new product has been under development in the research laboratories of Pittsburgh Corning Corporation, jointly owned by Pittsburgh Plate Glass Corporation and Corning Glass Works.

In addition to going to sea as the buoyant element in life-saving apparatus, the new glass is to be marketed as insulation in the cold rooms of meat-packing plants, breweries, dairies and ice cream plants. It will also be used in floats that support pontoon bridges.

THE SPONGE IRON PROCESS

THE world's oldest process of smelting iron will go into service in the present war effort as soon as small scale pilot plant operations are expanded. This sponge iron process, the subject of Congressional discussion, is considered practical by experts of the U. S. Bureau of Mines. Because it can use low grade ores it is urgently needed to meet the shortage of iron scrap.

Whether the process is cheaper or more expensive than others, whether it is superior or inferior, is beside the point. We need the metal. We must have it to feed our starving furnaces, especially the open hearth furnace for the production of low carbon steel for shipbuilding and other vital purposes. The sponge process will not replace the blast furnace. It will supplement it.

Two dozen or more individuals and concerns, including the Bureau of Mines, have been experimenting with the process. Only now has it had a real pilot-scale test. Small plants are successfully using it all over the world.

This so-called sponge iron process is the first by which man smelted iron from its ores. The ore was intimately mixed with charcoal in a small furnace or even on a forge. Air was blown in by a bellows. The temperature reached, 1,400 to 1,500 degrees Fahrenheit, was not sufficient to melt the iron, which gathered in a spongy or powdery mass at the bottom of the furnace. These characters were due to about 50 per cent. slag. This was afterwards hammered out of the metal, which was called wrought iron. There was also much loss due to oxidation. Some improvement was made by adding a limestone flux. All the iron and mild steel produced in ancient and medieval time up to the middle of the 14th century was produced in this way. Then the blast furnace was invented. This was nothing but a bigger furnace with a better blast operated by water power. About 1612 a further improvement was made by substituting coke for charcoal, motivated at first by the fact that England was being denuded of her forests by the voracious iron furnaces.

In the blast furnace a temperature of 2,700 degrees Fahrenheit or more is reached. This melts the iron, and the product is cast iron. Long after the introduction of the blast furnace, however, wrought iron was still preferred to cast iron, for cast iron is brittle and wrought iron is ductile. Nowadays it does not matter what way we get our iron, so long as we get it, for metallurgists

have learned to change its character, by subsequent treatments and alloying, in almost any way desired. The Bureau of Mines believes that with modern improvements, the old sponge iron process, originally primitive, laborious and wasteful, might become the equal of the blast furnace. The use of the method during the present emergency will ultimately answer that question.

SULFADIAZINE FOR THE TREATMENT OF COLDS

HOPE that with the aid of the sulfa drugs we might get through next winter and succeeding winters with fewer bad colds, attacks of bronchitis and pneumonia, appears in a report by Dr. Morris Siegel, of New York, in the *Journal of the American Medical Association*.

Sulfadiazine, given on the very first day a sore throat or other symptoms of a cold appear, can apparently speed recovery and prevent the cold from developing into pneumonia or into an attack of bronchitis severe enough to keep the patient in bed or maybe send him to the hospital.

Dr. Siegel gave this treatment, during an epidemic last winter, to a group of feeble-minded children who were particularly susceptible to colds and other infections of nose, throat and lungs. As controls, half of the children in each of the same two cottages at Letchworth Village were not given the sulfadiazine treatment the first day they showed symptoms, although all of them were given such ordinary care as their symptoms required.

"Most of the patients receiving sulfadiazine improved after 24 hours," Dr. Siegel reports. "A few had a secondary rise in temperature within 72 hours after premature withdrawal of the drug and some showed no evidence of improvement."

"For the first 12 hours after treatment was begun there was often no perceptible difference between the treated and control cases. Within 24 to 36 hours, however, there were usually signs of improvement in the treated group. The temperature fell and remained low. The patient appeared less toxic. His appetite returned and he was no longer restless and apathetic but brighter and more cheerful. Signs of infection, such as coryza (running nose) and cough, still persisted in many cases but the infection appeared to be subsiding, as if the inflammation had abruptly passed the acute stage."

During a second epidemic of a milder kind of infection, the sulfadiazine treatment did not seem to have much effect. This, Dr. Siegel believes, is probably because the second kind of infection was caused by a virus, which was not susceptible to the action of sulfadiazine. This suggests that effective control of colds, bronchitis and the like by sulfa drug treatment would depend on whether or not they were caused by germs of the kind that can be overcome by the drugs. Since germs of this kind are believed to be the cause of many of the worst symptoms of colds and the reason for colds lasting so long and so frequently ending in pneumonia, the chances seem bright for the sting of the common cold being drawn by the sulfa drugs.

CHOLERA AND THE SULFA DRUGS

HOPE that deadly Asiatic cholera can be conquered by

sulfa drugs appears in a report by Dr. James J. Griffiths, of the U. S. National Institute of Health. A single injection of sulfadiazine or sulfathiazole saved 50 per cent. of mice inoculated with enough cholera germs to kill 90 out of 100 untreated animals in 24 hours. From 80 per cent. to 90 per cent. of the treated animals survived the first 24 hours, 50 per cent. surviving for the 7-day test period.

The sulfadiazine and sulfathiazole were effective whether given by injection under the skin or into the stomach. Two other sulfa drugs, succinyl sulfathiazole and sulfaguanidine, were also effective when put directly into the stomachs of the cholera-infected mice.

India is the original home of cholera, but the disease can spread far along lines of travel and troop movements unless checked by rigid sanitary precautions. It is caught by drinking contaminated water or eating food contaminated with the vibrant, comma-shaped cholera germs which are discharged with the body wastes from patients or carriers.

Anti-cholera vaccine, which has been ordered for all U. S. soldiers likely to serve in cholera infested regions, gives immunity against the disease for about one year.

AUTOMOBILE OF THE FUTURE

WHEN the cessation of hostilities at last permits the manufacture of automobiles to be resumed, the new cars will be smaller, lighter, lower, cheaper and more economical than present ones, and some radical new designs with engine in the rear may be seen. This is the consensus of engineering opinion as gathered by Frank Jardine, chief engineer of the Castings Division of the Aluminum Company of America, published in the *Journal of the Society of Automotive Engineers*.

The first post-war autos will probably be similar to the 1942 models, and more expensive. Time will be required to develop the drastically changed new models, and meanwhile parts, tools and machinery already on hand will have to be used. Nor may we expect new cars to run off the assembly line the moment hostilities cease. Time is also required to change from war-time to peacetime production.

Here are some of the ideas of automotive engineers regarding the future car. But Mr. Jardine states that future events may require some considerable revision of present-day ideas.

While every one was agreed that the new cars would be cheaper, there was much variation as to actual prices. In the low price range, the average was \$700 for a car that would do 30 miles on a gallon of gas. The larger cars averaged \$2,000 and 20 miles to a gallon of gas. These economies would be required to offset higher gas taxes. Regular fuel would be 80-octane, premium fuel 100-octane. Weight of the cars would be reduced by as much as 1,000 pounds in some cases without reducing size.

It is believed that there would be extensive use of substitute materials developed during the war, with savings in weight and cost and in many instances with mechanical improvement. Increased production of aluminum and magnesium would permit greater use of these light-weight

materials. Plastic windshields curved at the corner posts will permit better seeing. Tires will be about the same but may be of synthetic or natural rubber. Hydraulic drives and brakes, automatic transmission and overdrive will definitely appear on all but the low-priced models. Engines will be smaller and lighter in weight. Carburetors will probably not be changed, but superchargers and fuel-injection systems may be developed. Eventually the engine may be placed in the rear.

ITEMS

RUBBER-LIKE substances, with at least part of the stretch and bounce of real rubber, have been prepared from soybean and corn oils at the Northern Research Laboratory of the U. S. Department of Agriculture at Peoria, Ill. Some of these products will stretch 200 per cent. or more and return to original shape; they show tensile strengths of about 500 pounds per square inch. Natural rubber averages a 600 per cent. stretch, with a tensile strength of 3,000 pounds or more. The substitutes are thus only approximations of real rubber in these respects. However, they may be able to do part of rubber's job in such things as waterproofing, resistance to abrasion and cracking, etc. In these ways they may be able to eke out the country's short supply of natural rubber.

DEHYDRATION, the process that makes one ship do the work of half-a-dozen or more in getting vegetables, eggs and milk overseas, is now at work on meat as well, according to an announcement made by Secretary of Agriculture Claude R. Wickard. Experiments have been under way for some time, and the technique has progressed far enough to justify its use with beef. Experimental work on pork dehydration is still in progress, and is regarded as promising. The beef is ground before dehydration, so that the product, after "re-hydration," is most suitable for meat loaf, meat pie and croquettes. A coarser grind gives meat suitable for stews. The product is reduced about three fourths in weight, and about half in bulk. At present, production is limited, for existing plant capacity is only about a hundred tons a week. Demand is far in excess of this.

"THE night has a thousand eyes" is strikingly true to-day, for all over the world amateur variable star observers are keeping their vigil of the stars known as variables. This is reported by Leon Campbell, recorder of the American Association of Variable Star Observers. The light variations of the unpredictable star called SS Cygni have been watched continuously since the star's discovery by Miss L. D. Wells, at Harvard, in 1896. Since then, nearly 60,000 estimates of this star's brightness have been received, representing the observations of over 500 observers, some of whom have watched the star for 20 years or more. Normally a 12th-magnitude star, about every 50 days SS Cygni bursts forth and becomes 20 or 30 times brighter, reaching nearly the 8th magnitude. Over 330 such outbursts have been recorded, some lasting only a few days, while others stretch over several weeks. But in 1933-34, the star decided not to follow its usual pattern at all. SS Cygni is a mystery to astronomers, who are seeking an explanation for its peculiar behavior.



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SCIENCE NEWS

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MEASUREMENTS OF NUMBER OF MOLECULES IN MATTER

NEW measurements of the number of molecules in a mass of matter equal to its molecular weight, known as Avogadro's number (thus for monatomic hydrogen a mass of about one gram), confirm the accuracy of recent previous measurements, and their departure from an older, long-accepted value still carried in many text-books. The measurements were made by Dr. R. T. Birge, professor of physics at the University of California, and were reported at the Berkeley meeting of the American Physical Society.

The latest Avogadro number, average of several determinations, is 6.02331 multiplied by 10 to the 23d power, which is 1 with 23 zeros written after it. Or we may say the number is 602,331 billion billion. This is the number of molecules contained in something less than an ounce of aluminum or in about a half a pound of iron. If all the inhabitants of the globe, about 2 billion, were to forget the war and start counting the molecules in an ounce of aluminum, and each counted at the rate of one a second and worked 8 hours a day, we should be blessed with universal peace for the next thirty million years.

The previously accepted value of Avogadro's number was 6.0230 times 10^{23} , also obtained by Dr. Birge in 1936 as the most likely value based on all previous measurements. The figure still appearing in many text-books is 6.064 times 10^{23} , which was also obtained by Dr. Birge in 1929 as a correction to the earlier value (1913 and 1917) of 6.062 computed by Dr. R. A. Millikan, of the California Institute of Technology. These figures were based on the famous oil drop experiment by which Dr. Millikan determined the existence of the electron and the value of its charge. Previous to 1913, investigators had only a very vague idea as to the magnitude of Avogadro's number. They knew definitely only that it was the same for all substances, a universal constant, of which there are only about a dozen.

Various methods other than that of the oil drop have been tried, but the most modern and most accurate is an x-ray analysis of crystals, using x-rays of known wavelength. This is the method used by Dr. Birge. He complains, however, that nearly all of the previous measurements of this sort were made on the crystal calcite, because this was the only one the properties of which, particularly the density, were known with sufficient accuracy. Recent accurate determination of the densities of lithium fluoride, rocksalt and the diamond made it possible for Dr. Birge to use these substances. Only the most perfect crystals were selected, and the results they gave agreed very closely. The unweighted average 6.02331 differed by less than 1 part in 10,000 from the value he obtained from calcite, 6.02276. These numbers, it is understood, are all to be multiplied by 10^{23} , or 100,000 billion billion.

SYNTHETIC RUBBER AND 100-OCTANE GASOLINE

THE use of hydrogen fluoride as a catalyst in place of aluminum chloride would not only speed up but would also improve and cheapen the production of synthetic rubber and of 100-octane gasoline, and save quantities of aluminum, chlorine and other critical war materials, according to an announcement made by Dr. Joseph H. Simons, professor of physical chemistry at Pennsylvania State College.

Three oil refineries now under construction will use hydrogen fluoride in a new process which will produce 100-octane gasoline without tetraethyl lead, and will use substances not previously available for motor fuels. Aluminum and chlorine are not only critical materials, but in their making consume vast quantities of electricity, a shortage of which is threatened as the war program expands.

A catalyst is a substance that promotes a chemical reaction but does not appear as an ingredient of the final product. Usually it merely speeds the reaction, but sometimes it will start one which would not have started without it. The catalyst can often be recovered, reconditioned, and used again. This is the case with hydrogen fluoride, but not so with aluminum chloride and similar agents heretofore used.

Hydrogen fluoride, or anhydrous hydrofluoric acid, is made from fluorspar, a mineral found in practically every country. It is the glass-eating acid, one of the most powerful acids known. Both the gas, fluorine and the acid are extremely poisonous. Early experimenting was much discouraged by a number of fatalities and injuries caused by breathing the fumes. But Dr. Simons has been experimenting with these substances for the past twenty years. He pronounces them quite safe if proper precautions are taken.

Through his researches, hydrogen fluoride was already used as a catalyst in 1939 in the production of benzene (a raw material of synthetic rubber), toluene (basis of TNT), aromatic compounds, dyes, drugs and other chemicals.

In the production of styrene, ingredient of Buna-S rubber which is slated to compose 70 per cent. of all our synthetic rubber, so much aluminum chloride would be required that its use should not be considered at all. Hydrogen fluoride will do a better job and save a totally unnecessary consumption of these critical materials.

SPECIAL MEASURES TO FIGHT EPIDEMICS

SPECIAL measures to fight epidemics and keep the nation's fast-growing capital healthy during war have been instituted by Dr. George C. Ruhland, Health Officer of the District of Columbia.

A door-to-door health census of all new arrivals will

be made as soon as the necessary staff can be recruited. The object of this health census, which Dr. Ruhland calls an "immunological inventory," is to determine whether the new arrivals have been vaccinated against smallpox and given inoculations against typhoid fever and whether their children have had toxoid to protect them against diphtheria. Those who have not had these health-protective measures will be urged to get them at once.

The city has remained healthy and free from epidemics so far. Air raid destruction of water supply and sewage disposal systems, however, is seen as a possible source of great, if temporary, danger. Because of this possibility, the District of Columbia Medical Society, acting on Dr. Ruhland's instigation, has warned every one in the National Capital to be immunized against typhoid fever. The entire staff of several departments of the District of Columbia Government and key persons in national Government departments have already been immunized against typhoid fever.

The Health Department of the District of Columbia, with the U. S. Public Health Service, is conducting a survey of mosquitoes in Washington and the vicinity. One variety of mosquito that can carry malaria has been found in near-by Oxon Run, Md. With the increase in air travel between Washington and the South has come increased danger that malaria-infected passengers or mosquitoes might introduce the disease to this city. The first step in fighting this possible danger is the survey to determine the number and location of any mosquitoes capable of carrying the malaria parasites, following which breeding places will be treated with oil or cleared.

The new budget for the local health department has allowed Dr. Ruhland to increase greatly his staff of sanitary inspectors. The new positions are largely being filled with women who, Dr. Ruhland thinks, are better fitted for the job of inspecting boarding and rooming houses to see that they meet health department sanitary requirements.—JANE STAFFORD.

THE PRODUCTION OF SPONGE IRON

DR. R. R. SAYERS, Director of the Bureau of Mines, has announced that two pilot plants of 30 to 50 tons daily capacity are planned by the bureau to test on a semi-commercial scale the production of sponge iron. The operation of these plants as well as direction of the research work will be under the supervision of Dr. R. S. Dean, assistant director of the bureau.

Past experiments of the Bureau of Mines dating back to 1927 and of others have shown the feasibility of producing sponge iron directly from the ore by the use of natural gas or of non-coking coal, cheapest of fuels. Smaller and less expensive furnaces can be used because the ore is not melted as it is in the blast furnace which produces pig iron. They could utilize small deposits of ore, deposits too small to supply a modern blast furnace. Such plants would not displace existing industry, Dr. Sayers stated, but would supplement it by providing low-carbon iron in place of vanished scrap to make steel for guns, tanks, ships and other war material. Ordinarily, pig iron and scrap are mixed to make steel.

Sponge iron can be produced from the ore by hot reducing gases obtained from natural gas or from coal by a "reforming" process. These gases contain carbon monoxide, deadly gas of the automobile exhaust, or hydrogen. The carbon monoxide combines with the oxygen in the ore, leaving metallic iron which collects as a spongy mass at the bottom of the furnace. These two processes, the one using natural gas, the other coal, will be the first to be tried out on a semi-commercial scale in the pilot plants of the bureau. But other processes will be investigated also.

A side-line use for the reducing gases would be the making of high-purity soft iron free from carbon by the reduction of highly pure iron oxide. There is a high demand for this material by electrical manufacturers, particularly for magnet cores and armatures. Much of it was formerly imported from Sweden.

Dr. Sayers stated that when the processes are proven, and the equipment has developed to a commercial scale, the scrap situation in this country will be alleviated a few months thereafter.

POISONING BY PUSS CATERPILLAR

WARNING against the danger of poisoning by the puss caterpillar appears in a report by Dr. Thomas L. Lucas, of the Walter Reed General Hospital, in the *Journal of the American Medical Association*.

Poisoning, serious but not fatal, of a man who had a caterpillar drop on his neck while walking through a southern Maryland cornfield first brought the danger to Dr. Lucas's attention. Severe itching with "wheals" ranging in size from a dime to a silver dollar was followed within ten minutes by burning pain, severe muscle cramps on the side of the neck and shoulder near the poisoned spot, and severe headache. An opiate (codeine) was required for relief of the pain. The skin blistered and peeled and healed "much as a first degree burn would be expected to heal," taking about ten days to heal completely.

Similar symptoms including nervousness, restlessness and rapid pulse rate occurred in several other cases which Dr. Lucas found had been reported in medical literature. Local treatment of the caterpillar "bite" is ineffectual, and the patient must be given an opiate or other drug with systemic effect. He believes that cases occur frequently but are not reported either because the patient does not see a physician or because the caterpillar is not recognized as the cause of the poisoning symptoms.

The puss caterpillar, known technically as *Megalopyge opercularis*, is a short, bushy variety which seems to rear upon its hind legs and "make a face" at any one coming near it. It has straight, sharply pointed, hollow spines which can prick the skin of any one touching it, thus letting the poison into the body. The exact toxic principle involved needs to be determined.

Puss caterpillars are widely distributed in the Southeastern states and may be spreading to neighboring areas. They may be found on oak, elm, plum and sycamore trees, in flower and truck gardens, in orchards and on corn.

EDUCATION OF MEN OF DRAFT AGE

AMERICA's draft Army is being selected from a population whose educational training is excellent. The number of American men between the ages of 18 and 25 who have completed less than four years' schooling is under 4 per cent., according to recent Census figures. Of the white male population under 25, only about 2 per cent. fall in this lowest educational bracket; in northern and western sections of the country the figure is 1 per cent.

Because the American people have misunderstood certain statistics, they have been led to believe that young men of draft age are "dumber" than they really are. Army deferments because of "literacy" requirements have given many people the false idea that there are millions of illiterate Americans of draft age, that is Americans unable to read and write, is pointed out by statisticians of the Metropolitan Life Insurance Company.

The Army has set its educational standards much higher than in the last war. Use of very complicated machinery and other equipment, on a large scale, has made this more severe standard necessary. So far, 430,000 men have been deferred for Army service because of inability to meet the Army's educational requirements. This basis for deferment has nothing to do with the 1940 Census classification of persons over age 25, with less than five years of schooling. There are 10,000,000 people in this classification. But a vast majority of these are in three special groups: immigrants who came into the United States before 1914, Negroes, and white persons from certain sections of the rural South.

Where complete illiteracy does exist, it is being wiped out rapidly. People over 25 who were frankly illiterate in 1940 comprise 3.7 per cent. of the population. In 1930 they represented 5.6 per cent. Among Negroes the improvement is particularly conspicuous: 10.0 per cent. in 1940 as against 21.3 per cent. in 1930. But even these figures do not represent the level of schooling of children to-day. They reflect, rather, the educational systems of a generation ago.

ITEMS

LOWEST death rate in the history of the United States death registration states was recorded in 1941, according to the U. S. Census Bureau. Provisional mortality statistics for that year, just tabulated, show a crude death rate of 10.5 per 1,000 population. The 1940 rate was 10.8, a slight increase over the previous low level of 10.6 reached in 1938 and 1939. There were 21,362 fewer deaths in 1941 than in 1940. Most of the decrease occurred in the rural areas. The greatest decreases were in the District of Columbia, Idaho and Vermont. The greatest increases in death rates for individual states were in Arizona and Virginia. The total number of deaths for the entire nation for 1941 was 1,395,507.

HELIUM, only non-inflammable gas suitable for balloons, will be produced in greatly increased quantities to keep aloft more blimps for coastal submarine patrol, to inflate barrage balloons, for deep-sea diving and for medical and scientific uses, according to Dr. R. R. Sayers,

director of the U. S. Bureau of Mines. Congress has appropriated \$4,000,000 for this purpose which will be made available from Navy Department funds. Production will be stepped up to several times last year's figures. Helium, the element first found in the sun, is now obtained from Texas natural gas. For some years past, the Bureau of Mines plant at Amarillo has been the only helium plant in the world and has given the United States a world monopoly of the valuable gas. Now a new plant will be erected at an undisclosed location, and bureau geologists are searching for other helium-producing fields.

ALL the nickel and at least a third of the copper used in printing plates can be replaced by iron, the National Bureau of Standards has found through research conducted in cooperation with the Government Printing Office. About 10,000 pounds of nickel and 350,000 pounds of copper are normally used every month by the printing industry in the manufacture of printing plates. Much of these strategic metals could be saved by the substitution of iron. The iron can be electroplated onto stereotypes and copper electrotypes, or true iron electrotypes can be made on wax and lead molds.

FIVE of the many vital war products now being produced synthetically in this country would require 2,682 good-sized cargo ships to bring a year's supply from overseas. They would form a bridge of ships across the Atlantic spaced a trifle over a mile apart. This is an estimate made by E. I. du Pont de Nemours and Company. The five products are nitrates for explosives and fertilizers, rubber, dyestuffs, textile fibers, and camphor for medicinal use and manufacture of many essential chemicals. Of these, only nitrates would still be obtainable if the ships could be spared. Chile was formerly our chief source. Now we are making nitrates from nitrogen drawn from the air. The other four products came from countries now in enemy hands. Ninety-five per cent. of our rubber came from countries now dominated by Japan. Most of our dyestuffs formerly came from Germany. Silk, now being replaced by synthetic fibers, came from Japan, and most of our camphor came from the Japanese island of Formosa.

ENTOMOLOGISTS of the U. S. Department of Agriculture report that guayule, one of the leading "white hopes" of the rubber situation, has a number of insect enemies. Most destructive among them is a bark beetle that does not attack the living plants, but feeds upon the heaped-up shrubs after harvesting. Thus far it is known only from Mexico, and it may be possible to keep it out of this country by suitable quarantine regulations. In any case, this new menace to our scanty rubber supply makes it desirable to process guayule as promptly as possible after it is gathered. The entomologists are also studying numerous other insect species that attack plants related to guayule, on the chance that they will transfer their unwelcome attentions to that plant after it has been widely established in cultivation. Among these potential enemies are root-eating white grubs (already known in guayule nurseries), wireworms, millipeds, caterpillars, grasshoppers, aphids, leafhoppers, mealybugs, mites and scale insects.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE DEATH RATE IN ENGLAND

A "REMARKABLY good wartime" death rate was registered in England and Wales during 1941 and the first three months of 1942, is reported by Dr. Percy Stocks, Medical Statistical Officer of the General Register Office in an article in *British Medical Journal*.

For 1941 the death rate, including violent deaths caused by the war, was 12.9 per 1,000 population. For the first three months of 1942, a period which almost invariably registers a higher death rate than the year as a whole, the total death rate, including deaths from violence, was only 14.8 per 1,000. For this same quarterly period in 1939, the rate was 15.1; for 1940, 19.9; for 1941, 17.5.

Even better index of the health of the country is the death rate from disease, which was 11.7 per 1,000 in 1941. During the same year, the United States, with the lowest death rate in the history of its death registration states, according to figures released by the U. S. Census Bureau, registered a rate of 10.5 per 1,000.

The infant death rate in England and Wales for 1941 was 58 per 1,000 live births. For the first quarter of 1942 it was 61, the lowest ever recorded in any March quarter. The birth rate was 14.2 per 1,000, compared with 14.9 per 1,000 in 1939 and 14.4 in 1933, the latter being the lowest hitherto recorded.

The most important increases in deaths from disease during 1941 were for tuberculosis, meningitis (cerebro-spinal fever in the English records), whooping cough and dysenteries and paratyphoid fever. "Tuberculosis has given rise to some anxiety," according to Dr. Stocks. Infectious diseases registering decreases, despite the war, are typhoid fever, scarlet fever, erysipelas, gonococcal infections, late syphilis and, among males only, recent syphilis, rheumatic fever, ear and mastoid disease, two kinds of heart disease (pericarditis and acute endocarditis), diseases of the mouth and pharynx, gastritis, appendicitis, and infections of childbirth.

For pneumonia, bronchitis and the like, "the cold winters and the conditions imposed by aerial warfare were unfavorable both in 1940 and 1941," Dr. Stocks reports. These offset the benefits of sulfa drug treatment of lobar pneumonia, so striking in 1938 and 1939, but the set-back has not been considerable. Bronchitis and bronchopneumonia, on the other hand, showed an excess of deaths in 1941, though not nearly so pronounced as in 1940.

Other diseases from which there was a noteworthy increase in deaths include: pernicious and other anemias, hemorrhagic diseases, Addison's disease, cerebral hemorrhage, heart diseases, epilepsy, mental disorders and ulcer of the stomach and duodenum.

Decreases, despite the war, were registered for gallstones and diseases of the gall bladder, pancreas, bladder and genital organs in both sexes; gout and diseases of the veins, skin, bones, joints and muscles in men; exophthalmic goiter, cirrhosis of the liver and toxemias of pregnancy in females; prematurity and birth injury in infants.

WORK OF THE WAR METALLURGY COMMITTEE

LEAD-SILVER in place of lead-tin soldering for tin cans is one of the recommendations of the War Metallurgy Committee and its Advisory Committee reported by Dr. Frank B. Jewett, president of the National Academy of Sciences, in a survey of the work of the two committees for the past eighteen months.

The substitution of lead-silver for lead-tin solder has been made in some fields. But in certain canning processes, difficulties are encountered which must be overcome by research before the substitution in this field can be ordered. Nevertheless, since a large proportion of the total consumption of tin is still used in soldering, such substitution in the canning industry is urgently needed.

The War Metallurgy Committee has at its disposal for war work more than 10,000 metallurgists in this country, research men, technicians, engineers. Their combined experience represents well over 125,000 man years. Heads of industries, university and research organizations also contribute their knowledge and experience. The results of Canadian and English research are made available.

The committee functions as a nerve center for the coordination and correlation of all this work, preventing duplications and mistakes and thus saving time and money. It portions out the work to various sub-committees and to organizations and groups best suited to carry on the particular kind of work needed. It serves also as a clearing house for the appraisal of new thoughts, new ideas, new shortcuts that may come from anywhere—and are coming in fast.

The chairman of the War Metallurgy Committee is Dr. Clyde Williams, director of the Battelle Memorial Institute, Columbus, Ohio; with Dr. Zay Jeffries, of the General Electric Company, as vice-chairman, and Louis Jordan, as executive secretary.

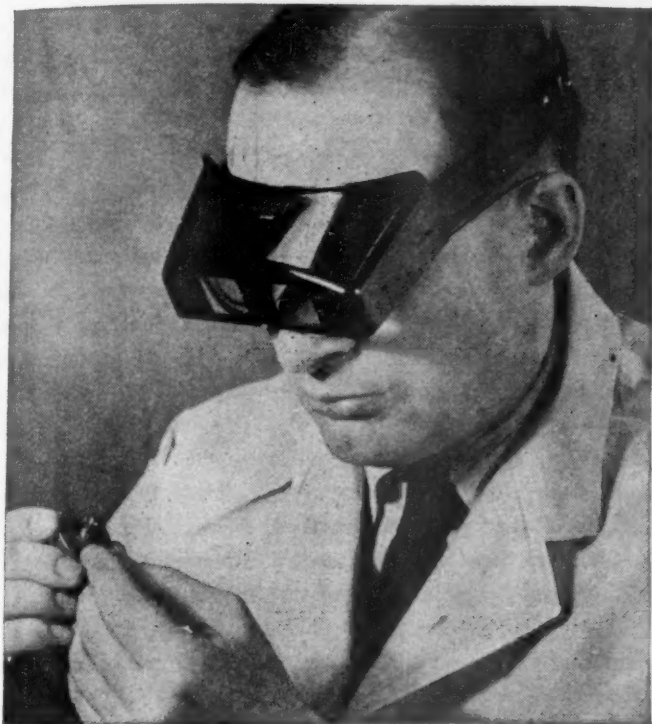
NEUTRON PICTURES

NEUTRON pictures in place of or to supplement X-ray pictures, taking advantage of the far higher penetrating power of neutrons—higher than 1,000,000-volt X-rays or even than the gamma rays of radium—are proposed in U. S. patent 2,287,619, recently issued to Hartmut Israel Kallmann and Ernst Kuhn of Berlin, Germany. The proposal is not new, and the invention is specifically confined to a compact self-contained device for producing the neutrons, slowing them down, that is, regulating their penetrating power, and protecting the operator and the object, especially when the latter is a living thing.

The preferred source of neutrons is a beryllium target bombarded by positive ions of heavy hydrogen, accelerated by application of 1,000,000 volts. This gives a volume of neutrons, the inventors say, equal to that obtained from 7 grams of radium intimately mixed with beryllium—more perhaps than has ever been gathered in one place.

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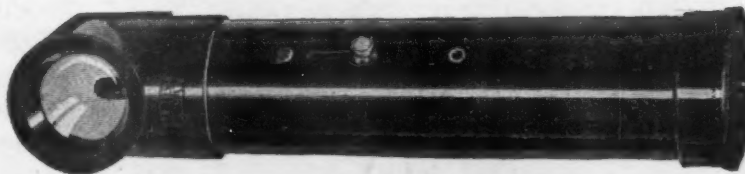
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down to the desired penetration by varying thicknesses of a hydrogen containing compound, such as paraffin or paraffin oil. This compound serves also to insulate operator and specimen from the high voltage. For further protection, the whole apparatus is surrounded by insulating material and this again by a conducting shell which is grounded.

While the inventors stress medical applications, it is obvious that the apparatus is also suitable for other applications, and we may be reminded that slow neutrons are the ones that have figured in the search for atomic power.

THE CAUSE AND CURE OF CANCER

THE cure of cancer will be achieved before the cause is discovered, is the opinion expressed by Dr. Cornelius P. Rhoads in his report as director of Memorial Hospital, New York City.

Search for a chemical cure for the disease, consequently, is being carried on at Memorial at the same time that investigations into the cause of cancer are made. No chemical cure has been found yet, but a method has been devised for testing in the test tube the poisoning effects on the cancer cell of various chemical compounds. So far, some seventy different compounds have been tested.

"A type of chemical has been found," Dr. Rhoads reports, "which in the test tube appears to interfere with the health of one type of cancer cell of man, that found in cancer of the breast, and in the same concentration not to interfere with the well-being of any normal organ tissue so far tested. The chemicals which have this preferential anti-cancer effect are characterized by a common structure.

"The results may have a far-reaching significance. They prove apparently that there is a real difference between cancer cells and normal cells in their sensitivity to certain types of chemicals. The cancer is more sensitive and can be killed by compounds which do not kill the normal tissue. This observation alone is sufficient justification for the intensive continuation of the experiments."

Dr. Rhoads is not yet ready to disclose the name of the type of chemical found to have this preferential anti-cancer effect because the studies have not yet gone far enough to justify considering it as a cancer cure.

Surgical cures of breast cancer in the primary operable stage have been achieved in 51 per cent. of all cases and in 75.5 per cent. of cases of the most favorable type (with no extension of cancer from the original focus). These cures represent patients alive and well five years after the operation.

Attempts to find a cure for cancer by starvation of the cancer cell are being made. Preliminary steps, now under way, consist in studies of the diet requirements of cancer and normal cells.

Delving into the cause of cancer, Memorial chemists, with the help of Harvard University, are engaged on the task of searching for cancer-causing chemicals in the kidney excretions of patients. Certain classes of chemicals, not unlike naturally occurring body chemicals such as the sex hormones, are known to be capable of causing cancer. Scientists believe that a defect in body chemis-

try may result in the cancer-chemicals being formed from the natural ones. If so, they should be present in the excretions of cancer patients but not of normal patients.

The difficulty of searching for them may be understood from the fact that the chemist who first described the chemical structure of the male hormones was able to isolate from thousands of gallons of kidney excretions about as much of the hormone chemical as could be placed on the tip of a pencil.

VITAMIN A IN THE DIET OF INFANTS

THE average diet of babies from three weeks to six months of age does not supply enough vitamin A for maintaining optimal concentrations of the vitamin in the blood, was stated by Dr. J. M. Lewis and Dr. Oscar Bodansky, at the Gibson Island Conference on Vitamins. The average diet given to infants over six months, however, does supply enough of the vitamin.

This vitamin is required for growth and good health generally, and also to prevent night blindness or poor dark adaptation of the eyes. Growth, resistance to infections and dark adaptation, however, are not as good criteria of the body's vitamin A stores as measurements of the concentration of the vitamin in the blood.

It was found that this last measurement is "the best single criterion available at present for the diagnosis of vitamin A deficiency."

The reason why so little night blindness has been found in children and adults in recent surveys, when many were believed to be eating poor diets, is that dark adaptation becomes impaired only when the diet is markedly reduced in vitamin A. The last finding was made on investigations with rats.

Optimal growth, these studies showed, occurred in the rats when the vitamin A content of the diet was 5 to 12 times the minimum requirement. Optimal concentration of the vitamin in the blood was observed when the vitamin intake was 12 to 25 times the minimum requirement. Good storage of the vitamin in the liver was noted at an intake of 50 times the minimum requirement.

OCCUPATIONAL DRAFT DEFERMENT

OCCUPATIONAL draft deferment is recommended for students in training for certain sciences as well as for scientific men now engaged in critical war research work in an "Occupational Bulletin" being circulated by Selective Service Director Lewis B. Hershey to local draft boards and other Selective Service officials.

A list of critical occupations is included in the bulletin. These are sciences and specialized fields certified by the National Roster of Scientific Personnel as requiring long periods of training and as being jobs for which the necessary manpower does not already exist to care for war production and activities essential to the war effort.

They are: accountants, chemists, economists, engineers (aeronautical, automotive, chemical, civil, electrical, heating, ventilating, refrigerating and air conditioning, marine, mechanical, mining and metallurgical including mineral technologists, radio, safety and transportation), geophysicists, industrial managers, mathematicians, meteor-

ologists, naval architects, personnel administrators, physicists, astronomers, psychologists and statisticians.

"Careful consideration for occupational classification should be given," the *Bulletin* says, not only for men already engaged in these activities necessary to war production or essential to the support of the war effort, but also to undergraduate college students in training for them if they are in their junior or senior years or at or near the close of the sophomore year.

A graduate or postgraduate student who is undertaking further studies for these scientific and specialized fields may be considered for occupational classification if, in addition to his studies he is also acting as graduate assistant in a recognized college or university or is doing war research which is supervised by a federal agency. After a student graduates, he should be given sixty days' additional deferment to give him time to get a job in war production or other war work.—MARJORIE VAN DE WATER.

VEGETATION ON MIDWAY

VEGETATION on Midway is certainly nothing to tempt a botanically-inclined person to seek assignment to that far-flung outpost, even in quiet times. Botanists of the U. S. National Herbarium, with headquarters in the Smithsonian Institution, say that there are only twenty plant species native to the two scraps of dry sand that compose Midway, mostly belonging to groups found on other Pacific islands.

One reason for this is the geological youth of Midway. It is one of the most recent of small land areas to emerge above the ocean surface, hence has had little time to develop a vegetation. It is so far from other lands that about the only ways plants can get there naturally is for their seeds to be carried by long-flight birds or to drift in on ocean currents. Chances are against seeds being carried that far by the wind.

Among the scanty list of plants on Midway, however, are two that are almost unique to these islands. One is a kind of mint, the other a species of nightshade, related to potatoes and tomatoes. The nightshade species is found only on Midway and on Ocean Island, a small neighboring bit of land.

The mint once formed part of the vegetation of Laysan, a tiny uninhabited island about a third of the way between Midway and Hawaii. With all the rest of the vegetation of Laysan, this species was wiped out by rabbits. The animals were accidentally introduced in 1903, multiplied by thousands and within ten years had nibbled away every scrap of plant life on Laysan, leaving the two square miles of its surface a sandy desert.

Two new plant species have recently been purposely introduced on Midway. They are San Francisco grass, brought in to bind and stabilize the shifting sand, and the ornamental shrub, oleander. A number of unintentional introductions were also made, when weed seeds arrived as stowaways in soil brought in by boat, so that the crew of the cable station could have a vegetable garden.

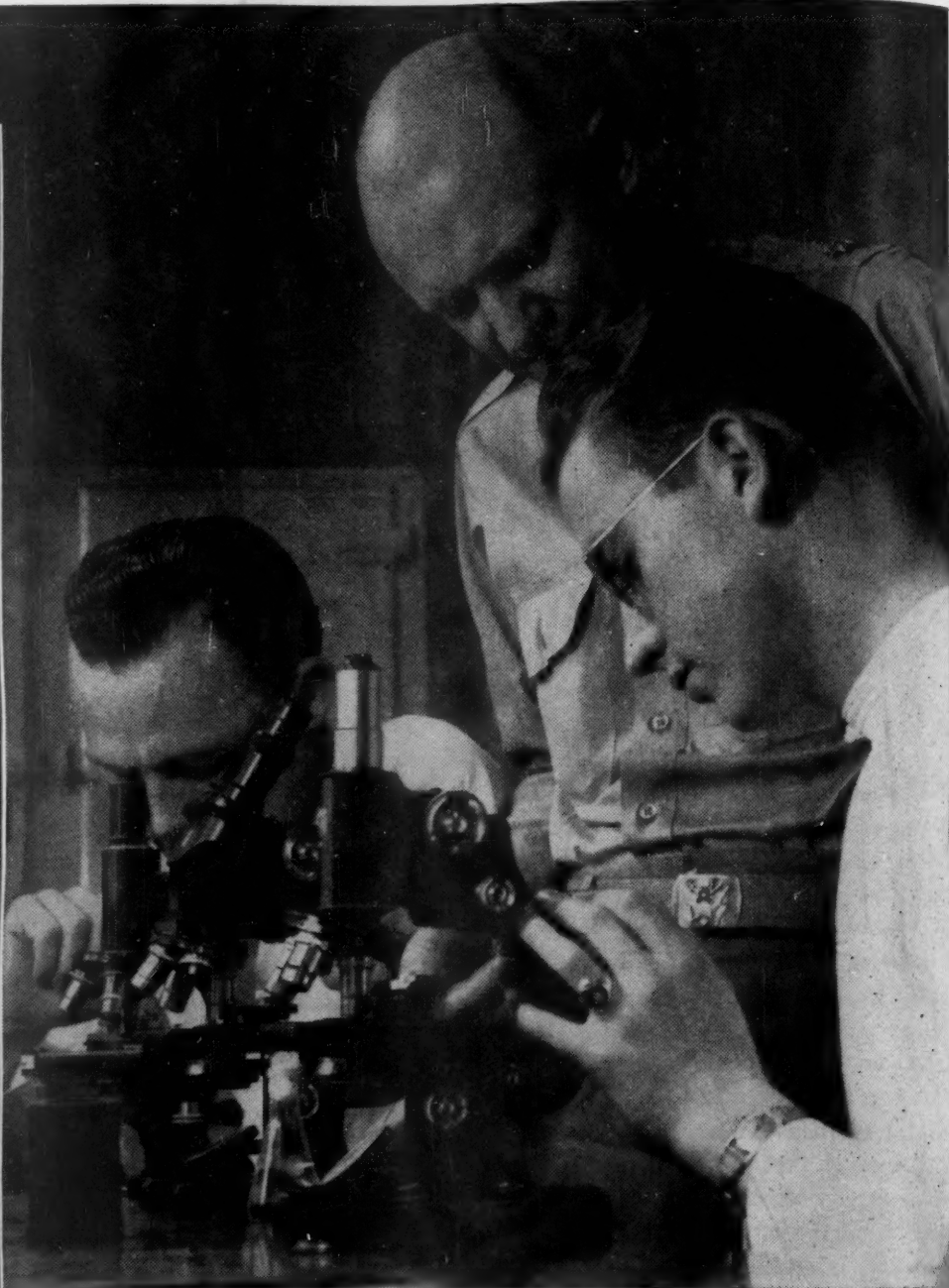
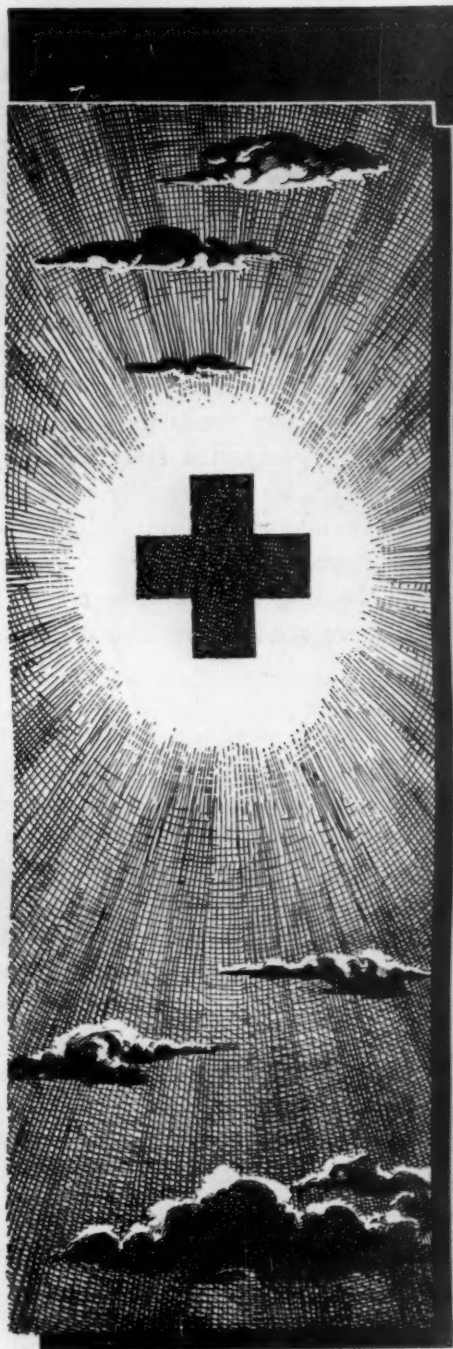
Whether there will be any further unintentional additions as a result of present intense military activities on the island is a question that can not be answered yet.

ITEMS

MAGNESIUM, though being used in enormous quantities for airplane production, is not going to be stinted to growing plants that need it, C. W. Whittaker and W. M. Ross of the U. S. Department of Agriculture have determined, after a critical survey of the fertilizer situation. Magnesium is an absolute "must" for all green plants—their food-manufacturing green pigment, chlorophyll, can not be formed without it. However, very little magnesium satisfies their requirement, and most soils naturally contain enough. Where soils are short of the element, a magnesium salt must be added to the fertilizer mixture. Before the war, American needs were met with a compound known as kieserite, imported from Germany. With this cut off by blockade, we can readily meet our needs by using dolomite, a magnesium-containing limestone, where long-time results are required. Where quicker action is needed, heating the dolomite makes it more soluble and hence more readily available to plant roots.

TOUGH cords of a special type of rayon, replacing cotton, permit thinner but stronger walls, add thousands of miles to the life of the tires, and save tons of rubber from which more tires may be made for army tanks and trucks. Applied to the airplane, the lighter tires permit heavier guns and bombs to be carried, and thus increase the fighting power of the plane. These are the claims made by E. I. du Pont de Nemours and Company in describing the new process by which they produce stronger rayon, rayon with a tensile strength of 70,000 pounds per square inch. The increased strength, the manufacturers say, is mainly due to stretching the filament immediately after it is formed. This is similar to the cold drawing of steel which so remarkably increases its strength. Partly responsible also is the use of cellulose derived from cotton instead of from wood pulp as for ordinary rayon.

"VICTORY lunches" that follow food-for-freedom diet rules are now being served to war workers in the cafeterias of three major plants of the Westinghouse Electric & Manufacturing Company, is announced by Dr. Frank M. Gatto, Pittsburgh director of health conservation. For 30 cents, workers can now get meals consisting of a liberal helping of meat, fish or eggs; vegetables; whole wheat or enriched bread; butter; and milk or a milk dessert. The lunches are planned to provide at cost a substantial portion of the daily requirements of vitamins, minerals, sugars and starches, proteins and fats, the foods people need to keep physically fit. Workers at the Westinghouse plants, Dr. Gatto reports, have swung to such nourishing foods as fruits and milk for mid-shift snacks. Recent surveys of the snack wagons that tour the plants show demands for oranges have tripled. From snack wagons and cafeterias come reports that Westinghouse employees are now eating 50 per cent. more green vegetables, 25 per cent. more salads, 10 per cent. more milk, and have doubled their consumption of carrots and lettuce.



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SCIENCE NEWS

Science Service, Washington, D. C.

NEW SOURCES OF ULTRAVIOLET LIGHT

To aid America's war effort, new sources of ultraviolet or black light have been perfected which cause fluorescent materials to glow several times more brightly than was previously possible, was reported by E. W. Beggs, lighting engineer of the Westinghouse Manufacturing Company, to the meeting of the American Optical Society at the Massachusetts Institute of Technology.

The new sources, which range from a walnut-sized bulb to a four-foot glass tube, use a new chemical coating that transforms short-wave ultraviolet to near ultraviolet. Chemical coatings also sift out the visible light.

Fluorescent materials glow when illuminated with ultraviolet light and cease to glow when the black light is turned off.

Thus an ultraviolet spotlight may pick up fluorescent markings in the dark which until then had been invisible. Maps, which must be read under blackout conditions, can actually be made to glow in several different colors. Fluorescent dials in an airplane will glow without the glare that would impair the pilot's ability to see out into the dark, and even this glow can be dimmed or extinguished at a moment's notice.

Phosphorescent materials, on the other hand, are like storage batteries of light. Activated for less than one minute by the ultraviolet light, they continue to glow for several hours afterwards. Other artificial sources may be used for this activation, but none is so efficient as the new mercury vapor fluorescent lamp.

Trail-blazing with fluorescent powders or paints is another one of the important possible new uses for black light. By this method, markings left on trees, stones and bushes remain invisible until picked out in the darkness by ultraviolet spotlights.

THE HEALTH OF THE NATION

THE nation's health continues good, according to reports from state health officers to the U. S. Public Health Service.

Only shadows on the otherwise bright health picture are caused by dysentery, meningitis, anthrax and infantile paralysis. The latter disease has caused a number of cases in Kentucky and Arkansas in the last week or two, but it is so late in the season that health authorities believe a wide-spread outbreak unlikely.

Texas reports the number of cases of bacillary dysentery as "very high." Of the 356 cases for the nation as a whole during the week ended July 25, 261 were reported from Texas. Virginia that same week reported 351 of the total 386 cases of dysentery of unspecified cause. The low reports from other states may mean that not all cases are being reported.

Reports of meningitis cases for some time have been higher each week than for the corresponding week of any year since 1937. Weekly totals for the nation run about 60 cases. Most of the cases are in the East, but so far the disease has not become epidemic.

A total of six cases of anthrax appeared in the latest available weekly report. The usual rate is one or two cases a week for the nation.

No human cases of plague have been reported so far this year. Anti-plague activities are being pushed strenuously by the Federal Health Service and by California, Washington, Oregon, Montana and Idaho State Departments of Health.

Some concern is felt over reports from the field investigators that large numbers of Norway rats have appeared along roadsides and around farm buildings in the Plains states, Kansas, Nebraska and the Dakotas. No plague germs have been found on any rodents within 200 miles of these areas, but the presence of the rats which may become a reservoir of the disease is causing some uneasiness.

Anti-plague units of the Public Health Service are vigorously searching for and destroying plague-infected ground squirrels and other rodents on and near military reservations and airfields in the West and Northwest.

BACTERIOPHAGE AND DYSENTERY
IN ALEXANDRIA

BACTERIOPHAGE, the germ-eater, is conquering bacillary dysentery in Alexandria, Egypt, is reported by Dr. Arthur Compton, director and pathologist-in-chief of the Laboratory Service, Alexandria Municipality, in *The British Medical Journal*.

In Alexandria, he reports, patients with bacillary dysentery died at the rate of 25 out of every 100 in 1928. Since 1938 only about 5 out of every 100 patients with this disease have died. In Cairo and the rest of Egypt the situation has not been so favorable. Case mortality rates for Cairo have varied between a maximum of over 60 per cent. in 1928 to a minimum of 25 per cent. in 1938.

The difference, in Dr. Compton's opinion, is due to bacteriophage, which physicians of Alexandria now give regularly to patients showing the first signs of dysentery. Since 1930, moreover, the Municipal Public Service in Alexandria has budgeted annually for commercial bacteriophages for the specific treatment of bacillary dysentery and like conditions in the municipal hospitals and children's clinics.

Thus the phage therapy (treatment) has been employed in Alexandria on an important scale for at least twelve years. In Cairo, phage has not been used to any appreciable extent until recent years and the rest of Egypt may be considered as practically not having known phage therapy at all.

VITAMIN DEFICIENCY AND HIGH
BLOOD PRESSURE

A DEFICIENCY of some of the B vitamins may be a cause of high blood pressure in some cases, it is suggested by experiments with rats reported by Dr. Royall M. Calder, of the Clayton Foundation for Research, Houston, Tex., in *The Journal of Experimental Medicine*. If the

experiments are confirmed and shown to apply to man as well as rats, the remedy for some cases might be better diet or doses of the proper vitamins.

Diets containing vitamin B₁ or thiamin, but lacking somewhat in the heat-stable vitamins of the B group, resulted in a "significant and persistent rise" in the blood pressure of the rats. This could be reversed by restoring the missing vitamins to the diet. The explanation, Dr. Calder believes, is that lack of these vitamins blocked the action of certain enzymes needed to make oxygen available to the kidney cells.

Every cell of the body requires oxygen in order to live and function. The cells of the kidneys may be deprived of oxygen if the arteries carrying oxygen in the blood are constricted. This is known to cause high blood pressure, and it is believed that it is the hardening of the artery walls which causes the constriction in human cases of high blood pressure. Dr. Calder believes that in some cases the high blood pressure due to lack of oxygen may occur, even when the artery walls are not hardened and constricted, as a result of failure of the cells to use the available oxygen. This failure might result from lack of vitamins or from some other condition that would make certain cells unable to use the vitamins.

No immediate human application is suggested by Dr. Calder, who presents his theory and experiments as "a working hypothesis" for further studies of the cause of high blood pressure.

SUN BATHING BY MINERS IN GREAT BRITAIN

MINERS at the Manvers Main Colliery in England now get daily sun baths by an assembly line method called both "revolutionary" and "unique in this country" by its designer, Dr. William Beaumont, of London, in a report to *The British Medical Journal*.

The miners, after their shower-bath, pass through a door and step onto a conveyer belt which carries them along a corridor which has mercury vapor arc lamps along its walls to deliver ultraviolet light. At the end of the corridor the men step off the conveyer and pass through a door to their clean clothes locker.

The assembly line sun bath is capable of providing sun baths for fifty workers every five minutes. It provides a minimal dose of the artificial sunshine, designed not as treatment but as a prophylactic measure to keep the men in good health in spite of lack of exposure to natural sunlight. The equipment is put into operation by throwing a single switch. Any defect or breakdown automatically breaks the electrical circuit supplying the apparatus.

The problem of providing artificial sun baths for factory and other workers as well as miners who work long hours under artificial light and lack opportunities for spending the week-ends in the open for some time has been exercising the minds of those responsible for the health of the workers and also those whose main concern is production.

Both the Germans and Russians, he adds, faced this situation long before the war. The Krupps mines at Essen, he says, have a "splendid installation" built in

the early days of the Hitler regime and the value of sun baths in factories was recognized in Russia years ago.

DUST ANALYSIS AND OCCUPATIONAL DISEASES

BECAUSE of the development of an inexpensive and comparatively simple technique of analyzing dust particles, occupational diseases resulting from the inhaling of contaminating dusts may be attacked on a new front.

Research just completed in the Research Institute at the University of Oklahoma has produced the new method, known as the polarographic analysis of industrial dusts, which employs an electro-chemical method of analysis. It was developed through the cooperation of the Oklahoma State Health Department and the University of Oklahoma Research Institute.

The study grew out of the difficulties that the Oklahoma Department of Health was having in attempting to solve the cause of poisoning that was prevalent among workers in smelters of the northeastern part of the state.

The dust particles available were so small that in many cases they could scarcely be weighed on even the best analytical balances, thus making it necessary to develop a new technique. With the polarograph the quantities of lead, cadmium, and zinc which are most detrimental to health were determined. In the new technique, all the elements present in the dust particles are determined with the spectrograph, and the quantities of lead, zinc, and cadmium are determined with the polarograph.

With the use of a polarographic analysis, industries now have a way of measuring the quantities of toxic constituents in the air in the various parts of the plants, and may remove the possibilities of poisoning by ventilating the various parts of the plants that present a health menace.

Robert C. McReynolds, research fellow, who worked under the supervision of Professor J. Rud Nielsen, has directed work on the project since the first of this year. He was assisted by Robert Ady, of the Oklahoma State Health Department.

THE TREES AND SHRUBS OF FLORIDA

SINCE southern Florida was first transformed from a mangrove swamp into a winter playground, trees and shrubs from all the world's warm regions have been imported and naturalized there. Almost every present and possible future battleground, jungle, bush or semi-desert where the temperatures remain mostly in the nineties and hundreds is represented by plants now growing along the populated coast of peninsular Florida.

First are the many palms and cycads. There are the fish-tail and toddy palms from southeastern Asia, the Areca and Sagisi from the Netherlands Indies, the spindle palm from Mauritius, the fan palm from China, date palms from India, and many specimens from Australia. In conservatories may be found *Actinophloeus Macarthurii* from Australia. This slender-trunked palm is quite rare. Among the cycads, that look like palms but aren't, are two sagos, one from East India, the other from Japan.

Among shade trees, the bunya-bunya, the Moreton bay pines, and the beautiful flame tree come from Australia.

Woman's-tongue, whose greenish yellow flowers rival in beauty the Poinciana, hails from subtropical Asia and Africa. Pink Shower, Mountain Ebony, and the Red Cotton Tree are from India. The so-called Australian pines (they are not pines) including the famous Beefwood or She-Oak range far up Florida's Coast.

There is the camphor tree from China; the eucalyptus from Australia; the Australian bush cherry; the lofty fig from India; the Java fig or weeping laurel from Malaya. From India comes an especially interesting planting, the Peepul or Sacred Bo-Tree. Sacred to the Buddhists, the Peepul is used as a temple tree in India, and may be the world's oldest transplanted tree. One of this species is still growing in Ceylon, brought there from India in 288 B.C. Then there is the Silk Oak and the Cajeput, or punk-tree, from Australia; the Longan tree from India; the Kaffir bean tree from South Africa; the African tulip tree, tamarinds and almonds from south-eastern Asia.

Finally among the shade trees is the sausage tree from tropical Africa. This is planted in Florida for the novelty of its fruit. The dull-red tubular flowers are followed by the large sausage-shaped fruit suspended from the limbs by long cord-like stems.

In Madagascar is found an old familiar friend in the Royal Poinciana. In Florida are many tropical grasses and bamboos, including one of the handsomest of the giant bamboos from Cochin China and *Cyperus Papyrus*, the Egyptian paper reed or Moses' Bulrush. Among the shrubs are many from the Pacific Islands, Java, Arabia, the Himalayas and Malaya. Then there are the snowy-leaved Crotons from Malaya, and the Chinese hibiscus, and many tree ferns from Australia.

As for fruit, Florida grows the East Indian lotus, the Malay apple, the Chinese guava and the Chinese litchie fruit, the madlar, or Japanese plum, and the East Indian mango. Exotic deciduous fruits are the Japanese persimmon and plums.

ITEMS

At a recent meeting of the Advisory Council, the National Cancer Institute has been authorized to put "at the disposal of the appropriate war agencies the facilities and personnel available for research aiding the war effort." Dr. Carl Voegtlin, chief of the National Cancer Institute, reported work showing for the first time that it is possible to convert normal mammalian cells growing outside the body into cancer cells. This was done by exposing the normal cells to the action of powerful cancer-causing chemicals. It is expected to aid understanding of how cancer is caused in the human body. The experiments were started in 1936 by Dr. Voegtlin and Dr. Wilton Earl. Four grants-in-aid, amounting to \$21,300, were made to the Chicago Tumor Institute, the University of California, Cornell University and Michael Reese Hospital, Chicago.

WARNING against use of sulfathiazole within the skull, which surgeons might consider as a means of fighting infection in war wounds of the head and brain or in operations for removal of brain tumors, appears in The

Journal of the American Medical Association. Convulsions and even death may result. Experiments showing clearly the danger are reported to Dr. Cobb Pilcher, Dr. Ralph Angelucci and Dr. William F. Meacham, of Vanderbilt University School of Medicine. They refer also to a report from English surgeons of five patients who developed epileptic seizures, two of them dying after sulfathiazole had been placed on the frontal portion of the brain to fight infection during brain operations. Sulfanilamide and sulfadiazine apparently do not have so irritating an effect on the brain, but the use of these drugs in brain surgery should be postponed until more is known about their action through microscopic studies now under way.

A NEW treatment for the headache and dizziness that follow concussion of the brain, expected to be more frequent as a result of war injuries, is reported by Dr. J. Y. Malone, of Milwaukee, in the *Journal of the American Medical Association*. The treatment consists of doses of a synthetic chemical, prostigmine. Patients treated by Dr. Malone swallow this medicine in a pill three times a day and also get it by hypodermic injection into the muscles twice a week. Relief of symptoms, in some cases within a week after starting treatment, and ultimate complete recovery was obtained in 14 patients. The treatment of this condition has heretofore been either unsatisfactory or complicated and extensive.

OVER a half million gallons of concentrated citrus juices have been ordered by the Government in Florida alone in an attempt to avoid scurvy outbreaks among the peoples at war due to vitamin C deficiencies. Improved methods of processing the fruits have been developed by the U. S. Citrus Products Laboratory. A large plant to be used for this purpose has been completed for the U. S. Department of Agriculture. The concentrated juice is now being put into medicine bottles for rationing to British children. By preparing the vitamin in concentrate in a special vacuum chamber a thick flavorful syrup is obtained which contains 85 per cent. of the original vitamin content.

A MUSCLE of the ear, the stapedius muscle, which acts to rock that bone in the ear that looks like a horse's stirrup, serves as a damping agent to protect the inner ear against excessive noise. This was learned in animal experiments conducted by Drs. Ernest Glen Wever and Charles W. Bray, of Princeton University, and reported in the current issue of the *Journal of Experimental Psychology*. This function of the stapedius muscle may be partly the explanation of why you become temporarily deafened, especially to conversational tones, while you are exposed to loud noise like that of an airplane engine or a boiler factory. Not only does tension of this muscle reduce the sensitivity of the ear to all noise, but it acts differentially to reduce the response more to low tones than to high ones. A peculiarity of its action is that for certain tones of middle range, a slight tension of the muscle actually improves the hearing. This would seem to indicate a minimum amount of noise may aid the hearing of some tones, such as those used in speech.

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SCIENCE NEWS

*Science Service, Washington, D. C.*WORK OF THE NATIONAL RESEARCH
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SCIENTISTS of the United States are making their knowledge and experience available for the war effort through committees of the National Research Council of the National Academy of Sciences. A great stock of information already in existence has been thus pooled, and has been placed on record in well over a hundred reports furnished to the War Production Board and its predecessor organizations. Directions which new research should take have also been indicated.

Especially important has been the work of the Metals and Minerals Advisory Committee, of which Clyde Williams, director of Battelle Memorial Institute, Columbus, Ohio, is chairman. This committee has already turned in well over a hundred reports. About half of them are on metals substitution and conservation, a little less than half on ferrous minerals and ferro-alloys, with several additional reports on tin smelting and reclamation and on non-metallic minerals.

A very considerable proportion of the reports are concerned with three "bottleneck" metals, aluminum, magnesium and manganese. The first two are basic materials for aircraft, the third is a key material in modern steel-making. With all three, our present difficulties arise largely from the fact that before the war the respective industries naturally utilized only the highest-grade sources, which were most easily worked. Now, however, these "cream" sources are not sufficient to meet the enormously expanded demand, and scientists are called upon to tell what may be done about realizing values from some of the "skim-milk" ores.

Other investigations of the committee range through the whole alphabet of the minerals, from antimony and asbestos to zinc and zircon. In some cases, rarer and more costly metals may become replacements for those that are more abundant and cheaper in normal times; as in the substitution of lead-silver solder for the old familiar lead-tin solder, thus releasing tin for use where it is more urgently needed.

This set-up of a national clearing-house for scientific ideas and information in a nation at war continues a tradition that goes back to the administration of President Lincoln. In 1863 he chartered the National Academy of Sciences as a means of making the then existing scientific resources of the country available for the use of the Federal Government.

During the first World War the National Research Council was organized as a committee of the academy, to carry on the same kind of work in the vastly more highly developed fields of science that had come into being since Reconstruction days. The council continued in existence during the interim between the first and second World Wars, and now again attacks the task, with greatly expanded personnel and facilities.

THE COMMITTEE ON TECHNICAL
DEVELOPMENT

THE Committee on Technical Development, a new body for the promotion and correlation of research in general industrial production, is now taking shape within the War Production Board, under the guidance of Maury Maverick, chief of the Bureau of Government Requirements. It is intended to operate along lines parallel to the work of the Office of Scientific Research and Development and the National Inventors Council, supplementing, though not duplicating, their efforts. An appropriation of \$100,000,000 is being asked for, to finance the work of the committee. Associated with Mr. Maverick in the new project are a number of research men and administrators, including Dr. Charles I. Gragg and Dr. C. C. Hill, Jr., both of Donald Nelson's organization.

As the research men picture their task, it involves several separate steps for each of the industrial problems with which the country is faced to-day. First is a survey of the problem itself, a determination of its magnitude and of all the factors involved that can be discovered. This is done largely by calling in groups of representative industrialists, engineers, and government and university research workers who know about various phases of the problem.

Having thus outlined a particular job, the next thing is to lay it out as a research project and find places where existing laboratory facilities will permit rapid work. This is very likely to involve a breaking down of the project into sections, and "farming out" the sections to universities and technical schools which have the necessary apparatus and personnel not yet employed on war research jobs. In this part of its work, the Committee on Technical Development would be functioning along lines analogous to those of the Smaller War Plants Corporation of W.P.B., in procuring the completion of jobs by sub-contract.

After the laboratory research stage comes the pilot plant, where processes until then done only by spoonfuls in test-tubes are expanded to middle-sized batches—say a couple of hundred pounds—in relatively small kettles or retorts, similar to those of factories, only not so big. Here is where the jobs graduate from "pure" chemistry into engineering chemistry, where "bugs" are discovered and eliminated.

Finally, after the pilot plant has carried the task so far as it can, it goes to the full-scale industrial plant for regular commercial development. The interval between pilot plant and factory is the "slip 'twixt cup and lip" where many a hopeful research project has died, and been embalmed in neatly bound research reports that only gather dust on library shelves, instead of rolling dollars in bank accounts and payrolls. One of the big jobs of the Committee on Technical Development will be to help practicable research results to become practical and real in the marketplace.



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Even before formal organization and financing, the committee has made a number of beginnings. One hitherto neglected possibility of natural rubber has been turned up in the strangling-fig vines that grow wild in southern Florida and the West Indies. Little is known about it as yet; it is one of the research tasks that will have to be done from the ground up.

Agar, a vegetable jelly made from seaweed and indispensable in bacteriological and medical research, has always been imported from Japan. Small American manufactures of this substance have been of good quality but insignificant in quantity. New seaweed sources that may help ease us out of this bottleneck have been turned up on the Florida coast.

Silk is still needed for certain military purposes; nylon, rayon and other substitutes have not proved wholly satisfactory. We have abundance of mulberry trees, a seed-stock of silkworms—and thousands of Japanese women in internment camps who would be glad of a chance to undertake their traditional job of unreeling the cocoons to earn a little money.

These are only samples of the thousands of projects awaiting formal organization of the Committee on Technical Development. The work that can be expected of it should not only aid materially in winning the war but in stabilizing the peace.

ALUMINUM FROM CLAY

A REPORT officially released by the National Academy of Sciences states that aluminum from clay may get War Production Board approval. At least the Board is considering several processes involving not only clay, but alunite, low-grade bauxite and other domestic sources in the event that our supplies of high-grade bauxite from British and Dutch Guiana, which has accounted for 60 per cent. of our whole supply, may be greatly diminished or wholly cut off by the U-boat warfare in the Caribbean Sea.

These processes have been investigated for more than a year by the National Research Council of the Academy, and a report has been made at the request of the WPB by Dr. Zay Jeffries, chairman of the Metals Conservation and Substitution Group of the Advisory Committee on Metals and Minerals.

All the aluminum in this country has been made until now from high-grade bauxite (containing less than 7 per cent. of silica) by the Bayer process, which is the cheapest way, provided high-grade bauxite is available. But this process does not extract all the alumina (aluminum oxide) from even the best of ore, and the poorer the ore, the greater the waste and the greater the expense for chemicals.

The clay processes can be used in two ways, the committee found. Aluminum oxide (alumina) can be extracted directly from the clay, or silica can be partially removed from high-silica (low-grade) bauxite to convert it to low-silica bauxite which can then be treated by the Bayer method. In either case the metal is then extracted by electrolysis.

The tailings, thrown out by the Bayer plants, called red mud on account of its color, can be considered as

clay, the committee pointed out, and the clay process applied. They recommended that clay-reducing plants be added to existing Bayer plants. High-silica bauxite can then be fed to the Bayer plant which will remove about 70 per cent. of the alumina and the clay process applied to the tailings will get most of the rest.

In particular the committee recommended that the clay process be applied to the millions of tons of red mud that has accumulated during the past thirty or more years at the East St. Louis plant of the Aluminum Company of America. This mud contains as much alumina as is contained in 1,000,000 tons of bauxite. It also contains large quantities of lime and soda, materials used in both the Bayer and the clay processes. The proportion of alumina to silica is higher than in kaolin clay which is almost pure aluminum silicate. It is good aluminum ore. It is already mined and pulverized, and contains a part of the materials needed for its own reduction.

There are two kinds of clay process, the acid and the alkaline. The committee favors the latter which consists in the main in mixing the clay with lime and soda, sintering and washing. The Tennessee Valley Authority has been experimenting for the past five years with an acid process applied to white kaolin clay, but the committee finds that the alumina it produces is not as yet sufficiently pure. However, the TVA is continuing its investigations and hopes to perfect the process.

Finally alunite or alum stone, a common mineral, is another source of aluminum. The reduction requires sulfuric acid, a substance for which there are enormous other demands in the war effort. But the stone is composed mostly of potassium-aluminum sulfate, so that the acid can be made from the sulfur present in the mineral.

Next to low-silicon bauxite the best ore for aluminum is high-silicon bauxite, and the best use of the clay process is in connection with a Bayer plant. Meanwhile search for new domestic sources of bauxite should be vigorously continued. There are no known deposits in Mexico or Canada.

JAUNDICE AND YELLOW FEVER VACCINATIONS

DANGER of jaundice breaking out in the Army among troops vaccinated against yellow fever is now over, in the opinion of the Surgeon General. Full information about the jaundice outbreak is now released for the first time, although this and other press services and newspapers of the nation have known about the outbreak for some time, but withheld the information at the request of Army authorities pending results of the scientific investigation which started when the first cases occurred.

Contrary to rumors circulating for some weeks, no case of yellow fever has occurred in any of the troops. The sickness was catarrhal jaundice, an ailment that occurs in civil life and for which no specific germ cause has been identified. Since March 1, there have been 28,585 cases of catarrhal jaundice in some of the men vaccinated against yellow fever. There were 62 deaths. This is a rate of one death to each 461 men who got sick, not one in 461 of all vaccinated. The numbers of deaths and of cases of jaundice were not large enough

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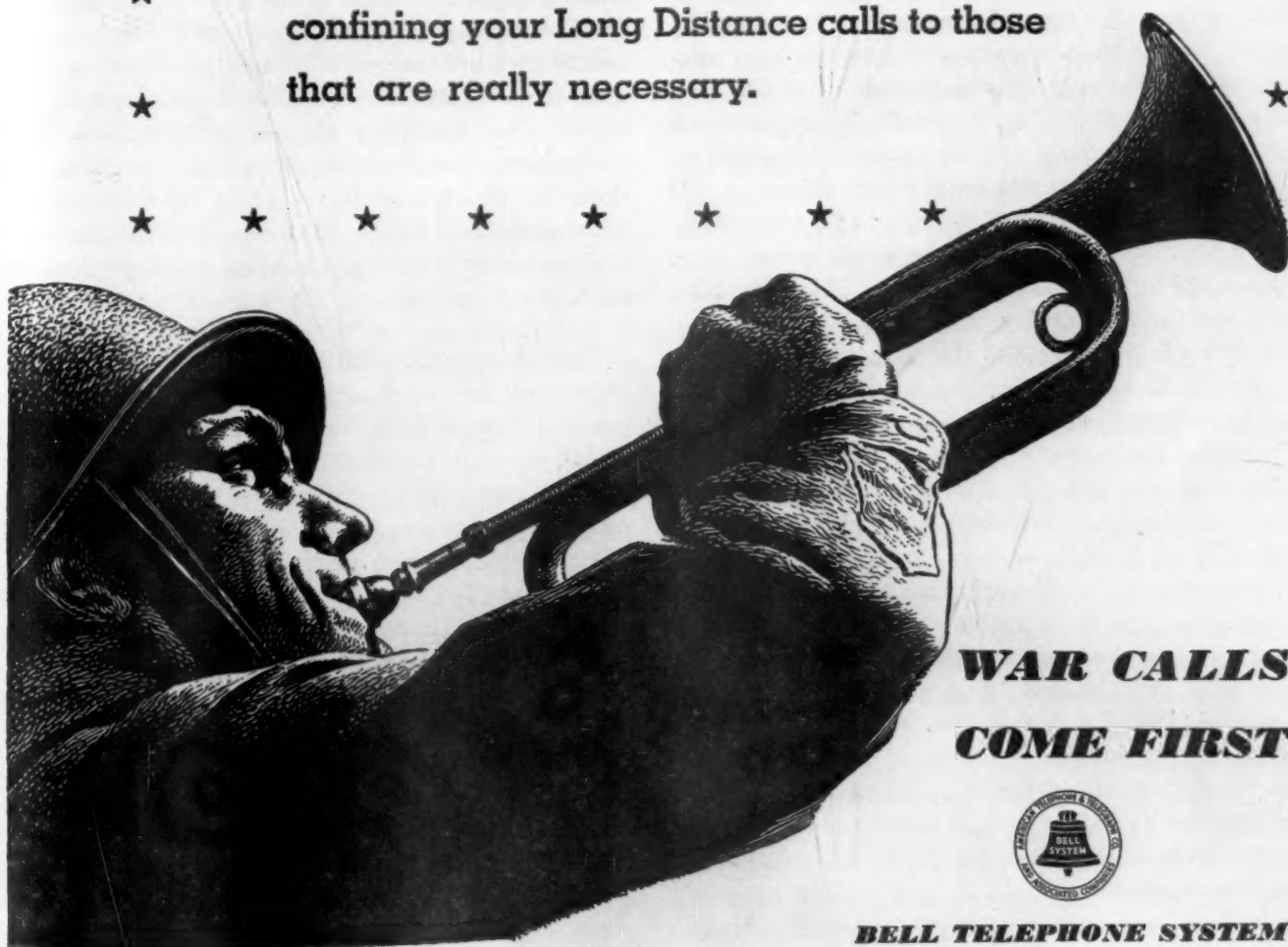
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to affect the war effort nor were they large enough to change the low death and sickness rates for the Army as a whole.

Jaundice occurred only in men vaccinated with certain batches of yellow fever vaccine. The vaccine was made from chick embryo pulp which had been suspended in normal human blood serum. This type of vaccine had been used for a million vaccinations before the jaundice cases developed among troops getting the vaccine.

The human blood serum was used because it keeps the vaccine active longer when it is stored before use. The unidentified germ of catarrhal jaundice may have got into certain batches of vaccine from this serum. The point is not yet definitely proved, but acting on the possibility, the Surgeon General has ordered all yellow-fever vaccine for the Army to be prepared with water instead of the human serum.

This change was made on April 15. Cases of jaundice have been definitely decreasing in numbers for the last three or four weeks. Peak of the outbreak apparently came during the week ending June 20, when 2,997 admissions were reported during the week. The peak in number of cases occurred after the vaccine had been changed because it takes some time for the disease to develop. The cases reported were among men who had been given the human serum vaccine before April 15.—JANE STAFFORD.

JAPANESE BEETLES

JAPANESE beetles are swarming over the great power dam at Conowingo, between Baltimore and Philadelphia. They're all over the roadway that crosses the huge concrete structure, thousands upon thousands of them.

Nobody knows why the beetles should be so numerous over the dam, except that they are pretty numerous all through their Middle Atlantic coast range this year. It is possible that mass flights of them, crossing the water or flying up air currents toward the dam, become tired and settle down to rest. All explanations that have been hazarded thus far are frankly guesses.

A real threat is the danger to the elms in ever-widening radius around New York City from the fungus plague that has been misnamed Dutch elm disease. (It didn't come from the Netherlands but from Central Europe.) Due to war-time economies in appropriations, and in particular to the dissolution of the C.C.C. and drastic cuts in the number of W.P.A. workers, it is not possible for public agencies to do any work within the area known to be infested. All that is being done this summer is scouting along the edges of the infested region, to find any new spreads of the disease.

The beetles that disseminate the fungus are breeding, flying and getting into new trees now, and they will be most active during all of August. Since federal aid in the elm disease campaign is lacking, local communities and private individuals who value their elms will have to look out for themselves.

Grasshoppers and chinch bugs are reported active in parts of the Midwest and Plains regions. The long, cool spring held them in check somewhat, but with the coming of warmer, corn-ripening weather they are asserting them-

selves. There is enough arsenic-poisoned bait to last out this summer's anti-grasshopper campaign, but since arsenic is an essential war material, used in khaki dyes and for other industrial purposes, it is unlikely that there will be any for use next summer. The best bet is to reduce this year's infestation as thoroughly as possible, so as to cut down the number surviving to lay overwintering eggs in the fall.

ITEMS

MANUFACTURERS of war equipment have been asked by the War Production Board to start immediate programs for salvage of the "over-spray" of the paint spraying process, from which 100,000,000 pounds of essential chemicals can be recovered, according to estimates of the Chemical and Textile Units of the WPB Conservation Division, based on a nation-wide salvage survey of the paint situation. Army tanks, trucks, jeeps, and other military machines must be mass spray-painted with the familiar olive drab. Millions of shells must have a protective coat of nitrocellulose lacquer enamel. It is estimated that about 30 per cent. of the materials used can be recovered from the sludge of the over-spray. Pigments, glycerine, oils, resins, gums, chlorinated rubber, cellulose and plasticizers are some of the materials that can be recovered by tried and tested methods, and the cost of the painting can also be reduced.

MILK-FED chickens may yield place, on premium market and restaurant listings, to soybean-fed chickens, at least for the duration. Soybean oilmeal is recommended as a substitute for dried milk in poultry rations, as increasing quantities of the latter food are sent overseas in Army supplies and lend-lease exports. The recommendation is made in a committee report of the National Research Council. In addition to replacing the milk proteins, soybean oilmeal is also a good source of riboflavin, one of the necessary vitamin materials ordinarily supplied in milk, the report states.

THAT hatchery raised trout can be distinguished from those that were hatched and grown entirely in the wild by examining their back fins, has been discovered by C. N. Feast, director of the Colorado Game and Fish Commission. Trout grown to legal size in a hatchery, he says, have dorsal fins somewhat degenerated through crowding. When they are released into the roomier waters of streams, the fins develop to full size, but are always malformed, and their cartilage structures are always cracked. This does not detract from the fish's health, gameness or flavor, but does form an identifying mark. Using this means of detecting hatchery-raised fish, Mr. Feast cruised the Gunnison, one of Colorado's best known streams, and found that 80 per cent. of the trout in it are hatchery-raised, a result of the commission's policy of raising its fish to full legal size instead of releasing them as fingerlings. Despite the war, there has been only a slight decline in number of fishing licenses. The decrease has probably been mainly among out-of-state fishermen, who find it more difficult to get to their favorite angling streams than in normal times.

SCIENCE NEWS

Science Service, Washington, D. C.

THE IMPORTANCE OF REST PERIODS

REST periods are vital to war production. This is stressed by the War Department, the Navy Department, the War Manpower Commission, the War Production Board and four other Government agencies in recommendations to war contractors.

America is at war and the ordinary leisurely summer-time vacations are naturally out for the duration just as touring and sightseeing are out. There can be no slacking of production, no relaxing of speed, no shutdown of any department that is needed in war production. But rest periods are important for each war worker. They should be carefully planned over the whole year or the longest possible period. In this way fresh, rested reinforcements are constantly being brought into service on the production front. Each day should have its rest periods. A 30-minute period for lunch is recommended by the Government departments. In occupations that involve contact with poisonous substances, workers must also be allowed time to wash up before lunch.

Industrial psychologists have found that the amount of rest and the frequency of the periods required for peak efficiency depends a great deal on the type of work being done. It should be carefully planned for each sort of job in a plant. In some work a compulsory ten-minute rest interval every two hours is best. In other types of work, it may be best to allow each individual to select his own time to take such a short rest period when he feels fatigued. According to the statement of the Government officials, "One scheduled day of rest for the individual, approximately every seven, should be a universal and invariable rule."

This does not mean any shut-down on Sunday. Plants and tools should be kept busy all around the clock and all around the calendar. But for the individual, a 7-day work week is injurious to health, to production and to morale, the statement emphasizes. Only in extreme emergencies should either workers or supervisors go without the weekly day of rest. Then it must be only for a limited time.

Psychologists would point out that this is even more important for the executive who does not need to punch a time clock than it is for the routine worker. The psychological effects of fatigue are insidious and treacherous. Enthusiasm for the war program and eagerness to do the job may keep an executive at his desk long hours and he may skip his weekly game of golf and his Sunday off. For a while that speeds the work. But after a while it becomes a little more difficult for him to make quick and sure decisions. Even more disastrous, against his will a sort of staleness may creep into his thinking. No longer is he eager to be at the job. No longer is he so sure of success.

British medical officers found that soldiers who have to make split-second judgments and keep up the fire of enthusiasm for their vital work must be forced to take rest

periods—not just to avoid crack-up, but to stay in top-form vigorous spirit.

The announcement of policy of the U. S. Government officials emphasizes that the wise conservation of human resources and the protection of working efficiency and morale is equally vital on the home front.—MARJORIE VAN DE WATER.

THE PRONUNCIATION OF STAR AND CONSTELLATION NAMES

YEARS of confusion in pronouncing astronomical names may now come to an end. Often when referring to a star or constellation that he used in navigating his craft through the air or over the sea, the aviator or mariner has given the name such an unfamiliar twist that the astronomer has had to think twice to realize the object meant. Now, however, the American Astronomical Society has adopted officially a new list of pronunciations.

Prepared after consultation with teachers and others interested by a committee consisting of Dr. Samuel G. Barton, of the Flower Observatory of the University of Pennsylvania, chairman; George A. Davis, Jr., of the Buffalo Museum of Science, and Daniel J. McHugh, C.M., of De Paul University, Chicago, the complete list appears in *Popular Astronomy* for August. It includes the 88 constellations used by astronomers, fifty important special star names, the nine major planets, three clusters of stars and the letters of the Greek alphabet. The latter are often used by astronomers. Thus, the brightest star in the constellation of Orion is called alpha Orionis.

The special name for this star is "Betelgeuse," but it has had a variety of pronunciations, even in astronomical circles. One is *bet-el-gerz*, another *beh-tell-gyou-eez* and another "beetle-juice." The committee decided on *bet-ul-jyuz*. The first syllable is accented. The second syllable is pronounced like the *el* in "angel," and the *u* in the third syllable has the same sound as in "emulate."

The bright star Aldebaran in the constellation of Taurus the bull, which, like Orion, is seen to the south on winter evenings, is often called *al-deh-ba-run* by navigators. The last two syllables are pronounced the same as "baron." Dr. Barton's committee adopted *al-deb-a run*. The third syllable is pronounced like the *a* in "abound" and the last like the *a* in "sylvan."

For Cassiopeia, the W-shaped constellation seen in the northeast these August evenings, *kass-ee-ope-ee-yuh* has often been used, but they recommend *kass-ih-oh-pee-yuh*. The *a* in the first syllable is like that in "hat," the *i* in the second as in "bit," the *o* in the third as in "anatomy," the *e* in the fourth as in "be" and the *a* at the end as in "sofa." The first and fourth syllables are accented.

Planet names are also covered. Most of these are familiar, but Uranus has been subject to variation. Thus, *you-ran-us* is sometimes used. Now, it has been decided, this should be *u-ra-nus*. The *a* in the second

syllable is as in "abode" and the u in the last like that in "circus."—JAMES STOKLEY.

SPLIT HEVEA SEEDLINGS

MAKING two rubber trees grow where only one grew before, by splitting *Hevea* seedlings just after they have sprouted, is the newest step toward the solution of the natural rubber problem reported by scientists of the U. S. Department of Agriculture. The technique offers the possibility of doubling the yield from the limited, therefore doubly precious, supply of high-quality pedigreed seeds available for the establishment of rubber plantings in the Western Hemisphere tropics.

Hevea seedling-splitting was first developed by Dutch plant scientists, working on the great plantations of the Netherlands Indies. Their methods have been tried out, with variations that may produce improvements, by H. F. Loomis, of the Bureau of Plant Industry, at the U. S. Plant Introduction Garden at Coconut Grove, Florida.

Seedling-splitting in *Hevea* depends on the early growth habit of the plant. The rubber-tree seed looks like an oversize castor bean—*Hevea* is, as a matter of fact, a botanical relative of the castor bean. Only, when sprouting takes place, the thick seed-leaves or cotyledons are not pulled out of the seed-coat but remain in it, feeding the young plant for a time through the leaf-stems still attached to the shoot.

The first method of multiplying rubber plants by dividing them consisted simply of splitting the whole seedling into equal halves, from shoot-tip to roots, a few days after germination. The split halves of the shoot soon died, but new shoots came from a pair of tiny buds in the angles between the seed-leaf stems and the original shoot. This method, first described by a Dutch botanist named J. C. Zweede, was called the Ramaer method, after the botanist who invented it, R. Ramaer.

Later, an improvement was made on it by another botanist, but it was named not for a person but for a plantation, the Gambar Estate, near Malang, Java. In the Gambar method, the split is not into equal halves, but the cut is made into the side of the shoot, just above the junction with the seed-leaf stems. This leaves the original shoot to grow up, while a new one forms from the bud on the "short" side of the cut. This gives quicker growth to one side, because the original shoot does not die as it does in the Gambar method. The new shoot that forms on the other side grows just about as well as it does under the Gambar technique.

In both methods, the split seedling halves are still "siamesed" together by their attachment to the seed-leaves held firmly within the seed-coat. They grow side by side in flower-pots until they are big enough to separate and set out separately.

In an effort to eliminate this operation, Mr. Loomis tried carefully cracking the seed-coat and separating the seed-leaves at the time of the splitting. This eliminated the labor of later re-potting, but this saving was offset by the death of some of the seedlings.

Mr. Loomis also discovered that young seedlings growing in the open, with their tops killed by cold or eaten off by rabbits, could be split and replanted successfully after

they had started new shoots from the side buds. Studies on this method, however, have been very few, and must be carried further before any recommendations as to possible practical application can be made.

SHARK LIVER OIL

SHARK fishing off the South Florida East Coast has been catapulted from a more or less despised calling to a vital defense industry. The reason is the urgent demand for shark liver oil, which is particularly rich in vitamins A and D. Shark liver oil is largely replacing Norwegian cod liver oil, now impossible to import.

Salerno, on Manatee Creek, up St. Lucie River, is the center of the revived and now flourishing shark industry. The sharks are caught on mile-long chain trot lines, baited with chunks of coarse fish every 25 feet, set on the edge of the Gulf Stream bottom and left overnight. The ends of the line are anchored and marked with buoys. Hauled to the surface the next morning by winches, the sharks are clubbed, brought to port and flayed. The livers are boiled for the oil, which is barrelled and shipped to Northern extracting plants. A shark's liver produces anywhere from two to 25 gallons of oil.

Varieties of the savage, cold-eyed scavengers of the sea, plentiful five miles off St. Lucie Inlet, include the nurse shark, hammerhead, tiger shark, leopard shark, lemon shark, mackerel shark and the great white shark. Sharks weighing up to and over 1,500 pounds, have been caught by the Salerno commercial fishermen. The average length is seven feet. The big fellows are the ones that got away, breaking the stout chain lines that held the three-quarter-ton "babies."

Sharks are processed as thoroughly as any pig in the Chicago stockyards. The skin is pickled in brine and goes to Newark, N. J., to be made into novelties and into a scuff-proof leather for the toe-caps of heavy working and hunting shoes. The fins find their way to the country's many Chinatowns for soup, and fetch a high price since the so-called delicacy can no longer be imported from Shanghai and Hong Kong; the flesh is chopped up for dog and poultry food and fertilizer; the jaws and teeth are sold for souvenirs; the backbones are made into walking sticks; and the eyes are dried, crystallized and polished as jewels for the novelty trade—now largely confined to men in khaki stationed in Florida.

Shark fishing is not without its dangers. Men have been caught on empty hooks, dragged overboard and drowned. Sudden tropical storms have sunk more than one shark boat. And now that German U-boats have commenced to machine-gun fishing boats the men of Salerno have another hazard to face.

But new boats nevertheless are being outfitted to go after the sharks. Shark liver oil is now as valuable and as sorely needed as rubber or tin.—J. HERBERT DUCK-WORTH.

PREVENTABLE DISEASE OF ANIMALS

IF a farmer lets his animals die of a preventable disease, there's a certain anti-social stigma attaching to such neglect. A man may own his animals, but he's under implied obligation to deliver them or their products in

good condition for the use of our armed forces, our working forces on the home front, our allies on the world's far-flung battle lines.

That letting diseases or parasites do damage unchecked is giving license to a ceaselessly active mob of saboteurs that even in spite of our best efforts still do American livestock well over \$400,000,000 worth of damage every year, is pointed out in the 1942 Yearbook of the U. S. Department of Agriculture which has now appeared.

Nor is the cash loss the only thing involved. Gove Hambidge, editor of the Yearbook, points out that diseased animals readily communicate some of their worst ills to human beings: anthrax, brucellosis, glanders, horse sleeping sickness, trichinae, tuberculosis, rabies and a whole medical chamber of horrors besides. Human beings in this country don't get foot-and-mouth infection because the eternal vigilance of the Bureau of Animal Industry has thus far stamped out every outbreak of this terrible plague of hoofed animals that has occurred within our borders.

The new Yearbook, titled "Keeping Livestock Healthy," is devoted entirely to problems of animal diseases and parasites. With a foreward under the slogan "Keep 'Em Healthy!" by Secretary of Agriculture Claude R. Wickard, the 1,238 pages are filled with 98 articles by eleven investigators headed by Dr. John R. Mohler, chief of the Bureau of Animal Industry.

Although the book takes up farm-animal diseases one by one, and animal by animal, it does not undertake to set up every farmer as his own veterinary. On the contrary, its aim is to enable the farmer to avoid need for calling the "vet" quite so often, especially since war needs have drawn off a large section of that none-too-numerous profession and the ones still available have to be "spread thin" and made to go as far as possible.

The 1942 Yearbook of Agriculture is the seventh, and regrettably the last, of a notable series edited by Gove Hambidge. Since the 1936 volume, each Yearbook has been devoted to one special subject: genetics, soils, food, climate, etc. Each has thus become a first-class reference book, unique in the agricultural literature of any language. The "economy" impulse of a Congress that cut off the Yearbook appropriation (while continuing to fatten the Congressional Record and frank it out by earloads) is much to be deplored.—FRANK THONE.

ITEMS

THE U. S. Department of Agriculture is trying to get stands of cork oaks, from whose bark cork is made, established in this country. But first, they have to learn where the trees will grow well. California is a known possibility, but there should be other places. It is requested that any one who knows of a really authentic cork oak, or a source of cork-oak acorns, to write in about it. Cork has become one of our severe wartime lacks. The only places where cork oaks grew in real numbers are the uplands of Spain, Portugal and North Africa.

SCIENTIFIC information and documents are being sent back and forth across the Atlantic in the form of microfilm—miniature photographs that may be read by en-

largement—in order to speed the mutual war effort of Britain and the United States. According to a statement made by Professor A. V. Hill, secretary of the Royal Society, the use of microfilm for scientific purposes began in the country in 1937 when literature in libraries was reproduced in this way for research workers. Regular scientific collaboration between American and British scientists has now been arranged with liaison officers in both capitals and other research centers. Experts are also ferried by air from one country to the other.

QUININE substitutes which will be official in the new U. S. Pharmacopoeia have been announced ahead of schedule, together with standards for their preparation because of the urgent need for protecting our overseas forces against malaria. Due to the present shortage of quinine, two synthetics, pamaquine naphthoate and quinaerine hydrochloride, may be of special value in keeping our armed forces free from the disabling periodic fever. Hearings are now under way in Congress on quinaerine patents which are alleged to restrict production. Totaquine, another anti-malarial, will also be in the new official book of drugs. This contains the familiar quinine but is mixed with several other related substances also found in the cinchona barks. It is expected that this mixture can be obtained from native cinchona barks found in Mexico and Central and South America instead of our former source in Japanese-held territory in the Far East.

BUTTER for troops in the tropics is practicable without the elaborate and costly refrigeration mechanisms that now make it such a problem. It can be "assembled" out of two milk constituents, butteroil and skim milk powder, has been demonstrated by Charles S. Trimble, of the Bureau of Dairy Industry, U. S. Department of Agriculture. Powdered skim milk and water are stirred into the butteroil, and the emulsion is poured slowly into cold water. Butter granules are formed, and may be worked into butter in the usual way. Butteroil is a clarified form of butterfat, which has been used in India for generations, under the name of "ghee." It also has some use in other dairy countries, notably Sweden and Switzerland. Butteroil can be kept from spoiling in hot climates by packing in airtight containers with all oxygen excluded. Dr. George E. Holm has developed a practical method for packing butteroil so that it will keep. At present, tin or other metal containers are used, but research is now under way to test the possible use of wooden kegs.

ADDITIONAL evidence that diabetic patients treated with a daily dose of the protamine zinc form of insulin may continue to excrete sugar and still remain in good health, is reported in the *Journal* of the American Medical Association. Large doses of insulin administered in severe cases to prevent excessive amounts of sugar in the kidney excretion, often result in alarming illness due to reactions from the treatment. But after careful study, Dr. Edward Tolstoi and his associates suggest that the daily dose of protamine zinc insulin without too much regard for sugar level in the body fluids often results in loss of other diabetic symptoms, maintenance of weight and satisfactory control of the disease.

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SCIENCE NEWS

Science Service, Washington, D. C.

RESEARCH IN PHARMACY

MEDICAL aid to war-time America may result from research work reported at the first session of the meeting of the American Pharmaceutical Association which opened at Denver on August 18.

Mercury in combination with saccharin, the sweetening agent, was prepared by Harry J. Pratt, Philadelphia, and J. Howard Graham, Glenside, Pa., and found to have superior qualities as a germicide.

New germ-killing substances were also reported by Dr. Milton Wruble, who combined silver compounds, long used in diseases of the ear, throat, and urinary passages, with the new sulfa drugs. Colloidal solutions of the creamy-white powder, silver sulfathiazole, were especially investigated and found to be efficient as well as less irritating to the eye and other delicate membranes, than many products now on the market.

A report from Oregon stated that ergot, the valuable drug used in childbirth and to prevent hemorrhage following delivery, was collected there and found to have two to four times the potency of the official standard. Discussion among the pharmacists gathered from every state in the nation indicated that research is going on in many parts of the country on this drug, which is a rye smut. Imports from Spain and Russia are practically non-existent and an acute shortage has been developing. One shipload that did make the hazardous journey was reported to be below the standard for these medicines in America.

The U. S. Plant Industry Office, the National Research Council, and the Committee on Botany and Pharmacognosy have, therefore, all requested investigation of domestic sources of ergot.

In the vitamin field, the application of a color method to find the amount of vitamin B₁ (thiamin) in pharmaceutical preparations was reported by Ernst R. Kirch, of Chicago, and Olaf Bergeim. The vitamin is reacted with a dye-like chemical and the color extracted with an alcohol. By determining the intensity of the color produced, the pharmaceutical chemist can calculate the amount of vitamin present.

MARRIAGE AND BIRTH RATES

MARRIAGE and birth rates, pushed to an all-time high by the war boom and the Selective Service Act, will hit a new low as soon as our full participation in this war is felt, was predicted by Dr. Philip M. Hauser, assistant director of the U. S. Census, at the Chicago meeting of the Society for Social Research.

With the death rate practically constant, last year's jump in the birth rate has brought U. S. population up to an estimated 133,039,000. Internal migration is increasing, with 1941 migration from farms to cities doubling that of 1940. This is expected to continue until the peak in war production is reached, including larger and larger percentages of women and Negroes as the labor shortage grows.

However, in the long run, according to Dr. Hauser, the

war will greatly decrease the rate of population growth. Since American economy has been built on anticipation of population increase, this may have serious economic consequences. Unless we succeed in successfully converting war production to consumer production, other post-war results will be depression and chronic migration of destitute workers, perpetuating the Dust-Bowl era on a larger scale. In any case we may expect a surplus of women following the war, says Dr. Hauser, which will create a class of women doomed to spinsterhood. Another dislocation in world population comes from the fact that this war is being fought by the "curtailed baby crop" of World War I. These "hollow classes" in the age pyramid of the nation will reappear in each generation, requiring many generations to erase.

However, post-war planners should study the effects of population as a cause of war, even more than the post-war effects on population, said Dr. Hauser. He hopes the settlement of World War II will recognize the danger of faulty distribution between population and natural resources, as the Treaty of Versailles did not.

HURRICANE DANGER

HURRICANE danger in Gulf and Caribbean regions is increased this year because of the radio silence imposed on ships at sea by the submarine menace. In pre-war times, reports of encounters with these violent storms gave warning of their approach long before they reached the land. Now, the only radio reports that can safely be made are those from the West Indian Islands.

With the number of Army camps, flying fields and Navy stations greatly increased in the South, and especially in Florida, the most exposed of all states to hurricanes, special precautions are being taken by military authorities, and particularly by the Red Cross, to guard against storm damage, and to be ready to move swiftly to the relief of any locality where a hurricane might strike. The civil population in the meantime is being advised to "get set" by putting houses, and especially roofs, into good repair, by laying in lumber and tools for boarding up windows if storm warning comes, and by preparing to store emergency supplies of drinking water, food, etc.

Hurricanes (and their China Sea counterparts, typhoons) could easily play a major part in the naval warfare now raging in all the tropic seas. While warships, even small craft like destroyers, are strongly enough built to battle their way through severe tropical storms, they can not possibly fight during one of them. Airplane carriers will remain afloat all right, but they can not launch their planes. The safest of all craft, during a hurricane, is a submarine. Even the most violent waves are not felt, a few fathoms down, so all that is needed is to dive and wait the storm out. Torpedo-damaged tankers, merchant ships or transports, trying to make port, on the other hand, will have their chances of survival gravely diminished. Ships in harbor are frequently in more danger during a hurricane than ships at sea. Japan, and lands now held by the Japanese, are espe-

cially exposed, however, to typhoons. Hardly a year goes by without typhoon damage somewhere on the Japanese islands themselves.

By whatever name they are known—hurricanes in Caribbean-Gulf regions and in parts of the Pacific, typhoons in Far Eastern waters, cyclones in the northern Indian ocean—they are all the same kind of tropical storm. They are generated in the heated, stagnant belt of air near the equator known as the doldrums. Once in a while an area of this heated air starts rising like an enormous bubble from the bottom of a pot. The earth's rotation indirectly sets it spinning—and a hurricane is born. It drifts toward the west, and away from the equator, and may finally sweep up the whole eastern coast of this country, as did the New England hurricane of 1938, or even swing out over the North Atlantic and finally blow its last breath out over Britain and northwestern Europe. Typhoons follow similar courses, ravaging the coasts of China and the Japanese islands.

Hurricanes that reach the West Indies and our southern coasts vary greatly in number from season to season. A fair average is about half-a-dozen, coming any time between mid-June and mid-November, but mostly during late August and the whole of September. Last year no storms of hurricane violence were reported by the U. S. Weather Bureau. The biggest hurricane year on record was 1933, when a total of 26 such storms was noted. On several occasions during that season two hurricanes were active at once—a performance unheard of until then.

This year's hurricane record may never be known—certainly not until after the war. Emergency warnings will be given threatened areas, but these must not be mentioned in any way more than 150 miles from the localities concerned. Only if actual disaster occurs will news stories and pictures be cleared for publication elsewhere in the country. All that can be stated now is that there has been no hurricane of any kind on southeastern American or West Indian waters thus far in 1942.

SEA-BIRDS KILLED BY CONTACT WITH FLOATING OIL

U-BOATS claim thousands of victims never mentioned in the tragic lists of "missing at sea." They are aquatic birds—ducks, gulls and many others—that get their feathers soaked in oil set afloat from torpedoed ships (sometimes, too, from the fuel tanks of submarines destroyed in combat) and either sink from exhaustion or struggle ashore only to die in misery.

This distressing picture of suffering is presented by Roger T. Peterson, of the National Audubon Society, in *The Audubon Magazine*.

Normally, swimming birds' feathers, filmed with the birds' own natural body oil, keep their bodies warm and dry, no matter how cold the water they swim and dive in. But contact with mineral oil breaks this natural protection. Cold water reaches their skins, and if they do not die of chill and exhaustion, pneumonia is apt to set in. In any case, a badly oiled bird becomes unable to fly, and hence unable to seek its food. Oil slicks on the water are deceptive death-traps. To birds, weary of flying, they are likely to look like patches of smooth

water. Only when the luckless fowl has settled on one of them does it realize its mistake, and then it is too late. Sometimes, too, a duck will dive somewhere outside the boundary of an oil slick and come up in the midst of the oil. Then its doom is sealed in a most literal fashion.

Sea birds have only minor importance as food, but they have more than esthetic significance in other ways. Gulls and some of their relatives are natural garbage incinerators, and do much to keep down the amount of rubbish on our water fronts. Eider ducks are prized for the light, warm down collected from their nests and used in making quilted jackets for aviators, seamen and others exposed to severe weather. Several thousands of these ducks have been oil-killed on Nova Scotia coasts alone.

Little can be done for oil-soaked birds. If they are really badly oiled, the most merciful thing is simply to make a quick end of their pain. Less severely oiled individual birds can be freed from the black contamination by careful treatment of their feathers with salad oil; but obviously that can not be done for more than a few out of the many thousands of seafowl.

THE RATE OF VIBRATION OF PLASTICS

AUTOMATIC machines bend plastic materials back and forth at speeds ranging from a slow wave to a singing vibration to test their fitness for airplane parts and for other uses subject to vibration.

When the specimen breaks, the machine automatically stops and the number of vibrations administered up to the moment of the break is recorded. An important result of the tests was the disclosure that the rate of vibration has an important influence on the number that can be withstood.

These and other tests on plastics have been carried out for the past two and a half years at the University of Illinois under the direction of William M. Findley, backed by more than twenty-five years experience of the engineering staff in putting metals through similar tests. The results are used by the American Society for Testing Materials to designate standard methods of testing plastics.

In another test, specimens hang along a wall of the laboratory with weights attached, and the stretch or "creep" is measured with microscopic fineness for periods of time from a day up to as much as a year.

These long-time "fatigue" or endurance tests are of extreme importance for the safety of our fighting men and civilian workers, for a piece will fail under oft-repeated or long-continued stresses much smaller than it could withstand for a short time. It is necessary to know how long a piece can be used or abused.

SUBSTITUTES FOR SHOE LEATHER

ALTHOUGH the leather supply is still adequate for shoes, particularly women's shoes, this situation may be reversed at any time due to government requirements for our own and allied war needs. For this reason, the National Bureau of Standards is busy experimenting with leather substitutes. Since the greatest shortage is to be expected in sole leather, most of the experimentation has been with non-leather soles.

The vogue for "wooden shoes," copied from leatherless Paris, has so far been confined to flat wooden soles on beach shoes, which make an interesting clatter on boardwalks, or to street soles which are hinged with leather for flexibility and padded for silence.

While some Washington shoe experts consider wood the best alternative to a leather sole, Everett L. Wallace, chief of the leather section of the Bureau of Standards, believes that present experiments will produce even better substitutes. Shoes are now being sold with thin leather soles covered with a layer of Vinylite or similar synthetic. These soles are said to have worn so well on children's shoes that the college girls have adopted them for active sports.

The biggest problem in adapting these plastics to the upper part of a shoe, according to Mr. Wallace, is their lack of porosity—that porous virtue of leather which "allows the foot to breathe" by absorbing perspiration. Waterproof synthetics are usually combined with more porous fabrics in women's shoes. However, other substitutes are being worked out which it is hoped will combine wearing quality with porosity. "Laminated" cotton fabrics are one solution—that is, alternating layers of cotton with layers of some synthetic material. A substitute named "Thiokol" looked like the perfect answer for a while, said Mr. Wallace, until its persistently bad odor caused complaints.

Men in civilian life would be more affected than women by any shortage of the heavier leathers needed by the Government, as well as by any shortage of the chemicals used in tanning. Therefore the new WPB ruling which requires more oil to be used in finishing sole leather is good news. Increasing the oil content from three per cent. to five per cent, is expected to result in a ten per cent. to fifteen per cent. increase in wear, because of oil's resistance to dampness. Since tanners have no way of knowing which hides will make shoes for the Government, and which for civilians, they are apt to treat all the heavier leather, at least, to meet Federal specifications. And that means longer wear for many of the shoes we buy a few months from now, including women's heavy walking shoes.—MARJORY ESTABROOK.

ITEMS

THE mass of the moon is now found to be $1/81.271$ of the earth's mass instead of $1/81.56$, as previously supposed. The probable error is plus or minus 0.021. The latest figure was calculated by Dr. H. Spencer Jones, Astronomer Royal of England. It is a by-product of his discovery last year that the mean distance of the sun from the earth is 93,003,000 miles instead of the previously accepted value of 92,870,000 miles. Both these results are based on observations on the planetoid Eros at its close approach to the earth in 1931. Unsettled conditions in the world and the resulting wars prevented earlier completion of the calculations. Despite the nearness of the moon, its mass is one of the most difficult astronomical measurements to make. It is done by determining the position of the center of gravity of the earth-moon pair. Then, as though they were two bodies attached to a stick balanced at this point, their relative

masses are proportional inversely to their distances from the supporting point or center of gravity.

New light is thrown on electricity and life processes by researches of Professor Harold S. Burr, of Yale University, who simultaneously took motion pictures and electrical records from growing corn plants. His results are set forth in detail in the new issue of the *Yale Journal of Biology and Medicine*. It had been known for some time that all living things give off minute electrical currents, but Professor Burr's experiments have shown for the first time that these variations in intensity correspond exactly with changes in the rate of growth, and with internal structural developments. Voltages as measured were low—from 25 to 75 thousandths of a volt. Some of the changes detected by the delicate instrumental set-up were quite abrupt. The more rapid fluctuations in plants, accompanying internal changes, are stated to be "curiously like brain waves in animals."

DR. A. L. KROEBER and Frank Essene, of the University of California, have found two living members of the Lassik, an Indian tribe thought extinct many years ago. They are both women, named Lucy Young and Mary Major, and they are living with Indians of other tribes on the Round Valley Reservation in Mendocino County. There is no doubt, however, according to Dr. Kroeber and Mr. Essene, that they are of the "vanished" Lassik tribe. Lucy Young is about ninety years old, and is possibly the oldest Indian in the state. Certainly she is the only one left in Mendocino County who can tell of the ways of her people before they made contact with white men. Discovery of these two Indian women makes possible the recording of ancient tribal culture patterns long since given up for lost.

A NEW greaseless cream, which applied to a worker's hands, arms and under the nails, protects them from grime and some irritating substances, has been announced by E. I. du Pont de Nemours and Company. The new cream is not medicinal, but forms an invisible protective film which at the end of the day can be washed off with soap and water, carrying the grime with it. Skin disorders comprise two thirds of all occupational diseases, according to the statistics of one major insurance company, and newcomers whose hands are not yet hardened are especially susceptible to them.

THE hairy Ainu of the northern island of Japan are not very closely related to the white peoples of Western lands, according to studies received at the Smithsonian Institution of L. Stenberg, the Russian anthropologist. Instead, they belong to a general "Caucasoid" complex shared with various peoples of southern Asia and Indonesia. They may even have some vague relationship to the bearded black natives of Australia, despite an almost exactly opposite difference in skin color. The Ainu, who contrast sharply with the Mongolian race in their general hairiness and especially in their long beards, live very primitively in the small area into which they are crowded. Despite their northern location, they keep many of the habits of a southern, seafaring people.

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SCIENCE NEWS

Science Service, Washington, D. C.

MEDICAL CARE OF THE FIGHTING FORCES OF THE UNITED STATES

SPLendid provisions for the medical care of our armed forces have been made.

The medical corps of the Army and Navy have been trained and strengthened to meet the medical needs of our fighting forces in days to come. More than that, throughout the country, in universities, scientific research institutions, and research laboratories of commercial companies, a great organized effort is in process. Our medical officers are being equipped with the latest and most improved resources of medical science.

Discoveries made between the last war and this have lessened enormously the risks of fatalities and disablement from wounds. Treatment with sulfanilamide and other sulfonamide drugs has been shown to yield results which promise better than 50 per cent. reduction in mortality from wounds and wound infections compared with the last war.

At the present moment eight teams, each consisting of highly skilled surgeons and bacteriologists, are at work in hospitals in Boston, New York, Baltimore, New Orleans, Nashville, Detroit, and Akron, studying the best choice of these drugs, the best methods of their application, the best methods of supporting treatment. The cases which they study are derived from traffic accidents, accidents in industrial plants, chosen because of their similarity to those which are encountered in warfare. In eight other institutions, fundamental questions of infection and wound healing are being investigated by skilled laboratory personnel.

Another formidable menace to fighting men is the condition known as "shock." It may arise from wounds and loss of blood. Failure of the heart and circulation is its most prominent feature. It is treated by rest, heat, morphine and blood transfusions. In "shock," the blood vessels apparently lose their capacity of retaining the fluid of the blood within them, hence the necessity for an artificial replenishment of this fluid.

Salt solutions, injected into the blood vessels, leak out at once and are only momentarily effective. Whole human blood is effective but under field conditions is largely unobtainable. Stores of human blood plasma, either liquid or reduced to dry powder by special arts of desiccation, have been accumulated and are ready to be supplied to the armed forces in field, and the evacuation and general hospitals.

The most effective constituents of blood plasma in combatting shock are proteins. Of these the albumin is most important because it is present in largest amount and has the greatest capacity for holding the fluid in which it is dissolved within the blood vessels. The brilliant work of a group of investigators at Harvard has resulted in the development of methods by which the albumin of human blood plasma is separated in a state of high purity and high concentration and can, with a minimum of difficulty, be distributed to army surgeons.

Great work is being done by blood donor centers. Acquisition of supplies of human blood requires extensive organizations of citizens, physicians and technicians.

They make one think of the millions of gallons of beef blood which are being thrown away yearly in our slaughter houses. If beef albumin could be prepared in such form and so pure as to be harmless when injected into man, an unlimited supply of an essential therapeutic agent would be made available with infinite saving of money and human effort. Harvard investigators are now devoting intensive efforts toward this goal; the results thus far obtained give encouraging promise of success.

Airplane design has achieved incredible capacities for speed, altitude and maneuverability. These involve the subjection of our flying personnel to strains and stresses for which the human body seems never to have been designed.

Perhaps the most important task which confronts military medicine of today is that of learning how to equip the flyer with the means of protecting himself against the conditions to which the perfections of his plane subject him. He must be prepared to resist rapid changes of temperature, from tropical heat to most intense arctic cold; to rise quickly from sea level to heights five to seven miles up—heights at which the breathing of pure oxygen, unless under pressure, will not maintain life.

In dive-bombing, for example, he must be able to withstand the terrific strain of suddenly reversing the direction of flight at speeds of hundreds of miles an hour.

To such physical strains are added the mental and nervous tension of life and death combat in which his every sense must be alert.

Much has already been done in devising mechanical equipment to overcome these difficulties. More remains to be done. Guided by the studies of the Committee on Aviation Medicine, the Committee on Medical Research has arranged for the installation of elaborate equipment and the employment of physiologists, physicists and physicians in a dozen universities where these problems are being and will continue to be studied under conditions most favorable to success.

If victory in this war is to be achieved by air superiority, you may be certain that that superiority will depend upon the learning of the physiologist as well as upon the genius of the engineer.

These are only a few instances of the researches that our investigators are conducting. Search is under way for new and more effective means for the prevention and cure of malaria and other infectious diseases; of coping with possible gas poisonings; new drugs are being discovered and invented, some of which seem to give amazing promise. What will emerge from all this effort is not only increased capacity to fight this war but the acquisition of a body of scientific medical knowledge which can not fail to be of permanent value to us all.—A. N. RICHARDS, *Chairman of the Committee on Medical Research, Office of Scientific Research and Development.*



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EGG PRODUCTION

EXPERIMENTAL attempts to increase egg production from German hens by feeding them female sex hormone are described in a nearly year-old copy of the German journal, *Die Umschau*, which has been received in Washington, after lying no one knows where, since several months before the entry of the United States into the war. They are reported by an experimenter named Lothar Zirngiebl, whose address and connections are not given.

Herr Zirngiebl states that he was interested in trying the hormone when a notable decline in egg production, on the part of German hens generally, set in during the spring of 1941. He claims that one group of 14 hens brought its daily production from only one or two from the entire penful up to as many as eleven eggs a day. The weight of individual eggs also showed a notable increase.

However, results of this experiment can not be taken as conclusive. Aside from the small number of hens included in the experiments, the circumstances precluded the close supervision necessary for good scientific work. The hens did not belong to the experimenter; he had to persuade a not-too-cooperative owner to let him use his birds. Furthermore, there was no control group: there should have been an equal number of hens fed and treated in exactly the same way except for the addition of the hormone to their feed, for comparison. Without such control animals, biological experiments are not usually considered reliable.

Finally, there is that matter of the general decline in egg production. It may have been statistical rather than biological. After the first World War, German country people would tell an American visitor, after they got to know him well enough: "The blockade? Well, it was hard on folks in the cities, but here on the land we didn't fare too badly. They sent food requisitioners around, but there were ways of evading them. For instance, we ate eggs as soon as they were laid, and then told them our hens had stopped laying."

Perhaps something of the kind is going on again. Not even the Gestapo can keep a nose in every nest.—FRANK THONE.

POWDERED VEGETABLES

THE convenient small cans of strained vegetables for babies may be out for the duration, but mothers will not be forced themselves to cook and strain the baby's vegetables. Dried, powdered vegetables can be safely substituted for infant feeding, according to Dr. Reuel A. Benson, professor of pediatrics at the New York Medical College.

Convenience is not the only result expected from Dr. Benson's findings. Babies and small children in war-devastated regions are particularly in need of vegetables in easily digested form. Many more of them will be able to get these foods, because from eight to ten pounds of fresh vegetables are reduced to one pound by dehydration, with consequent saving in shipping space. That even two-day-old infants can be safely given the powdered, dried vegetables when suitably diluted with water, is announced in a report appearing in the *Archives of Pediatrics*.

Babies under four months of age are usually not given vegetables, even strained ones, because of the difficulty at that young age of swallowing solid foods. Dr. Benson does not recommend routine use of the powdered vegetables for very young infants. The fact that eighty-four newborn infants were able to take the dehydrated vegetables from the second to tenth day of life without harm shows, however, that they may be safely given to older babies. The powdered, dried vegetables were also given to thirty-four older infants and thirty-six older children without any trouble. The drying process does not appreciably lessen the nourishing value of the vegetables except for loss of anti-scurvy vitamin C.

The dried vegetables may be given in more concentrated form to counteract constipation in infants and children. Powdered vegetables may also be useful for allergic children, since the process may alter the protein content somewhat as the protein in evaporated milk is altered so that it causes less sensitivity than fluid milk.

SYNTHETIC RUBBER PLANTS

BY making steam do two jobs instead of one in the new synthetic rubber plants, electric power will be created, enough not only to run the entire plant and neighboring works but with some to spare which will be added to the regular public utility lines to help supply other war industries. This is the message given by F. H. Stohr, of the Westinghouse Electric and Manufacturing Company, which is making the turbine generators for this purpose.

Steam is plentiful about plants making butadiene and styrene for Buna S rubber, for it is needed in the chemical processes. By passing it first through a turbine and then through the chemical vats, all the necessary chemical work is done and a large amount of power is created as a "by-product." This power is in excess of the plant's needs, so that instead of taking precious power from the public utility lines, the plants will actually deliver power to them.

Three generators are now building, one of 35,000 kilowatts, two of 40,000 kilowatts. They take steam at 750 to 850 pounds per square inch and deliver it to the chemical line at 175 pounds. These generators and others to be built will be installed in the first four large synthetic rubber plants in this country, scheduled for completion in 1943. The output of all the Buna S plants at the end of 1943 is expected to be at the rate of 360,000 tons a year. With other plants to be built, synthetic rubber production is expected to approach the 1,000,000 ton-a-year rate by the end of 1944.

OILS FROM FRUIT PITS AND STONES

REMEMBER how you saved prune pits during the first World War? It looks now as if fruit pits and stones are going to be put to use again, though in a different way and for another purpose. What they wanted, in 1917-18, was the shells, for gas mask charcoal. They have plenty of that now.

What's wanted in this new war are the kernels within the pits, for the oil they contain. Such special oils as sweet almond oil, formerly imported, are on the list of war-shortages now, and the oils from apricot, peach and

cherry kernels resemble this rather closely. Prune-kernel oil would do nicely, too, but not many prunes are pitted at the processing plants.

It is not likely that housekeepers, restaurant owners and mess officers will be asked to save fruit pits this time. It is easier and far less expensive to go to the concentrated, quantity sources, the canneries and fruit-drying plants, where fruit pits have long been a useless waste, fit only for burning under the boilers. In normal times, the expense of cracking the pits and extracting and refining the oils has been too great, but with the price of oils much higher it seems worth while to install the necessary machinery.

Another source of vegetable oil that is recommended for industrial attention is the avocado. This fatty fruit has been steadily gaining in favor during recent decades, but as yet there is no really good, paying outlet for the disposal of culls and damaged fruits. Avocado oil is very much like olive oil in quality and flavor. Incidentally, despite the large quantities of olives raised in the West, domestic olive oil has never supplied more than five per cent. of the American market.

So-called rice bran oil has also received comparatively little attention. If ways can be found to prevent it from turning rancid, according to chemists of the Department of Agriculture, it can be used as a substitute for the now scarce vitamin-rich sardine oil in animal feeds.

MENTAL HYGIENE

PREVENTION of crime and delinquency, successful treatment of "problem" and backward school children, and the early detection and prevention of serious mental disorders have resulted from the pioneer work of the Suffolk County Health Department of New York, in setting up a mental hygiene program for rural areas. An encouraging report of its first year's work is given by Dr. George M. Lott, director of the Suffolk County Mental Hygiene Division, the first of its kind to be organized by a county health department. Dr. Lott's report appears in Public Health Reports of the U. S. Public Health Service.

In its work of prevention, the Suffolk County Mental Hygiene Clinic serves as a sort of classroom for parents and teachers, and a conference room, as well as a clinic. When a problem child is referred to the clinic, for instance, his teachers, his family doctor, the school nurse, and any one else interested in his welfare may all meet together and plan a cooperative program of treatment.

This method is not only valuable to insure cooperation among the various people and agencies involved in a case, but it provides a program of education in the principles of mental health. Several cases of "delinquent" boys are reported by Dr. Lott where such prompt cooperation and treatment undoubtedly saved them from reform school or jail. The importance of re-educating parents is illustrated in several cases where a normally intelligent child was failing in school.

ITEMS

AERIAL spread of two dangerous diseases, rabbit fever (tularemia) and Rocky Mountain spotted fever, is now suspected as a result of a discovery by Charles R. Joyce,

Iowa State College entomologist, and Gaines W. Eddy, now of the U. S. Bureau of Entomology and Plant Quarantine. It was found that the nymphs and larvae of the common rabbit tick appeared on 29 kinds of birds examined at the Tama Indian Reservation. Although rabbit ticks rarely attach to man, and are therefore not directly responsible for transmitting the diseases, it is believed they spread the diseases among rabbits. From this reservoir of infection the diseases may spread naturally to other species of ticks, such as those which carry spotted fever. On one brown thrasher the entomologists found 495 young rabbit ticks, and 2,111 were removed from 24 of these common song birds. Hosts for the young rabbit ticks were found to include also the cat-bird, indigo bunting, wrens, towhee, robin, and other species of ground-feeding birds.

X-RAY machines that will stand up to hours on end of hard use under the severe conditions of military service and be perfectly safe, are assured by rigorous tests carried out by the National Bureau of Standards. The requirements are so severe that most machines fail to make the grade the first time they are tested. Then they must be remodeled and often the new model fails also. Sometimes models have been sent back half-a-dozen times before a machine was produced that could meet the strenuous military requirements. These machines are used to test the physical fitness of inductees, to examine injuries at army hospitals, to test materials in shipyards, airplane factories and other plants producing war materials.

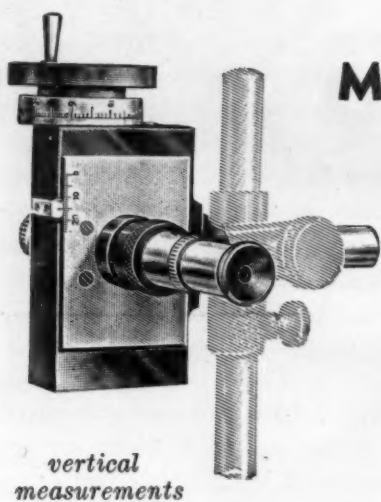
ONE part castor oil to one part ethyl cellulose is the composition of the new plastic recently announced by the Hercules Powder Company to replace rubber in many of its uses. The new material has not the bounce of natural rubber, but there are many things for which rubber has been used which do not require this bounce—washers, gaskets, gloves, galoshes, garden hose, etc. It is estimated that sixty thousand pounds of rubber have been used in these ways annually, simply because it was cheap and plentiful. For all of them the new plastic is just as good, and in some ways better.

LATEST note on how to make rubber last as long as possible comes in an announcement, in the *Journal* of the Canadian Medical Association, of a new formula for a lubricating jelly for surgeons' rubber gloves, catheters and other rubber supplies. The formula was worked out by Professor W. E. MacKenzie, assistant professor of pharmacy in the Ontario College of Pharmacy, at the request of the Canadian Hospital Council. It calls for starch, distilled water, sodium lactate and mercuric oxy-cyanide. The new jelly is needed not only because of the rubber shortage but because of the increasing shortage of gums and glycerine used previously in non-greasy lubricating jellies for rubber supplies. It can be made in any hospital pharmacy for about 50 cents a pound and can be sterilized under steam pressure. It does not deteriorate on storage, nor does it harm either rubber or human tissues. It contains an anti-bacterial substance.

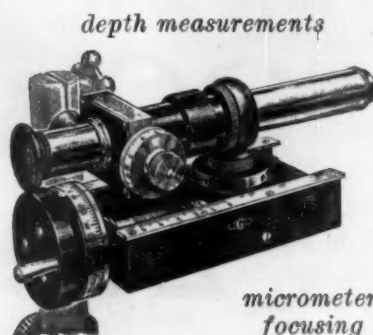
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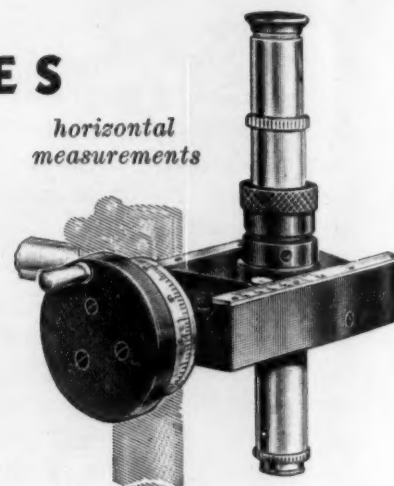
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three chapters devoted to the interrelations of organisms, the distribution of animals in time and place, and the origin and evolution of animal life. Short chapters on the history of zoology and on classification and nomenclature, which contains a synopsis of the animal kingdom by phyla and classes, are included.

Part II covers the phyla and classes of animals. The chapters are organized on a common plan, but varied to suit special cases. Each includes a summary of group characteristics; comparisons with other phyla or classes; descriptions of one or more common representatives; etc. New advances in various fields of biology are dealt with. Special tables summarize such topics as the vitamins; characteristics of blood cells; Mendelian characters of man and of domestic animals, the geological history of animal groups; etc.

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SCIENCE NEWS

Science Service, Washington, D. C.

SPECTRAL LINES

A SUBSTANCE impossible on this earth, but lying in the vast stretches of so-called "empty" space between the stars, partly clears up an astronomical mystery of long standing. It accounts for three of four spectral lines that have puzzled astronomers. The fourth is still unexplained.

The substance is hydrogen carbide or carbon hydride, whichever you prefer to call it. But astronomers simply call it CH, for the molecule is composed of one atom of carbon and one of hydrogen. The final step in the proof was accomplished by two Canadian physicists who looked not at the sky but through the eyepiece of a spectrometer in the laboratory. The physicists are Dr. A. E. Douglas, of the National Research Laboratories in Ottawa, and Professor G. Herzberg, physicist at the University of Saskatchewan.

The spectrometer is the instrument that spreads light out in a rainbow and tells what things are made of here and in the skies, provided the spectrum "lines" are identified with similar lines given by a known substance. Each line corresponds to a particular wavelength of light. A good instrument will measure this to a 25-billionth of an inch. Astronomers examining the stars with this instrument have noted four sharp lines which did not correspond to those of any known substance. On theoretical grounds and as a result of mathematical calculations they attributed them to CH, existing in the space between the stars. Much of this work was done by Dr. Theodore Dunham, Jr., and Dr. Walter S. Adams, of the Mount Wilson Observatory in California, and Dr. Andrew McKellar, of the Dominion Astrophysical Observatory, B. C.

But the astronomers could not be sure of their conclusion, because since CH does not exist on the earth, its "lines" had never been seen. All this has now been remedied, for Dr. Douglas and Dr. Herzberg have produced three of the lines in the laboratory and positively identified them as belonging to CH. The fourth line which did not appear, they gave good reasons for believing does not belong to CH. Hence the fourth line still remains a mystery.

The reason why CH, and we may add CH₂ and CH₃, are "impossible" compounds on this earth is that the normal quota of the carbon atom is four atoms of hydrogen. If it has a less number, it is unsatisfied or "unsaturated," and immediately sets out to fill its quota. It may accept other atoms than hydrogen or it may join with other unsaturated hydrocarbons to form the large groups or the long chains that compose the molecules of petroleum, rubber and other organic compounds.

The carbon atom has no difficulty here in filling its quota, with plenty of materials close at hand, 500 billion billion molecules to a cubic inch of air. But out there in "empty space" it is believed that there is about one atom or molecule to a cubic yard. If the carbon atom were magnified to the size of a pea, and the cubic yard

were similarly magnified, there would not be another atom of any sort within a million miles. The carbon atom would be lucky to get even one hydrogen atom to share its loneliness, and however much it might yearn for more, it would be a long time before it got any. CH can therefore very well exist for prolonged periods in "empty" space.

The manner in which the CH lines were produced in the laboratory was by admitting a small amount of benzene to an atmosphere of inert helium gas and passing an electric discharge. Apparently the discharge broke up the hydrocarbon molecules of the benzene and CH existed momentarily while the carbon atoms were filling their quotas. How short this time is may be gathered from the fact that CH₃, which would be the most stable of the three compounds, had previously been produced in the laboratory, but half of it disappears in 1/1,000 to 1/10,000 second. The lines obtained were very faint. Exposures of one to ten hours were required to photograph them.

Twice before have mysterious spectral lines puzzled astronomers. They were then attributed to new elements not yet discovered on the earth, but in both cases they turned out to be very common earthly substances, but in a peculiar state. They were the mysterious green lines seen in the spectra of nebulae, which were attributed to an unknown element, which was called "nebulium." But in 1927, Dr. I. S. Bowen, of the California Institute of Technology, showed that it was simply oxygen and nitrogen emitting "forbidden" lines, possible only when the gases are extremely attenuated. Again, a conspicuous green line and others in the spectrum of the sun's corona were attributed to an unearthly element and named "coronium." But in 1941, the Swedish astronomer, Dr. Bengt Edlen, showed that these lines were probably due to atoms of iron and calcium stripped of most of their electrons by some powerful agency that had not been duplicated on the earth. Finally, 1942, the Indian scientist, M. N. Saha, proposed that the highly damaged atoms were produced by "fission," the famous process by which physicists are seeking atomic power.

In any case it is believed that all possible elements have now been discovered. No new ones will be found in the sky.—MORTON MOTT-SMITH.

THE GROWTH OF PLANTS

WHAT plants want for growth, reduced to simplest possible terms by experimenting with separated bits of plant tissue, was described at North Truro, Mass., at the annual symposium of the Society for the Study of Growth, by Dr. Philip R. White, of the Rockefeller Institute for Medical Research at Princeton, N. J.

Dr. White used three kinds of plant tissue cultures, similar to the chick heart and other animal tissue cultures made famous by the classic studies of Dr. Alexis Carrel. They were detached root-pieces of tomato and other plants, fragments of abnormal tumor-like growths

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THIS well-known book deals with the biological problems of growth and form, and form and function, in their necessary relation to physical principles and mathematical laws. It has been out of print and very scarce for many years, but now at last has been carefully revised, reset, and considerably enlarged.

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produced by a hybrid tobacco whose parent strains "disagreed with each other" and pieces of crown-gall growth provoked on sunflower stems by bacterial attack.

Plant tissues, it was found, need eleven mineral salts (containing sixteen elements), a supply of carbohydrate, three vitamins and one amino acid. Omission of some, like magnesium, calcium or sugar, causes immediate stopping of growth. Lack of others results in slowed-down or abnormal growth.

In the case of the masses of tissue from the tumor-like formations Dr. White found that the oxygen supply had a great deal to do with the kind of growth that would occur. As long as there was plenty of oxygen, they kept on producing cells that were practically all alike growing in no particular direction. But when any of these irregular lumps happened to sink beneath the surface of the nutrient fluid, thus reducing the oxygen supply, it would begin to develop stems and leaves. Brought up to the air again, it would revert to its original formless condition.

Dr. White expressed the belief that there must be other kinds of plant material that would lend themselves equally well to experiments on growth control, leading eventually to information of value in such widely separated fields of research as the growth of diseased tissue and the growth of crops.—FRANK THONE.

COLCHICINE

COLCHICINE, known nowadays primarily for its use in originating new plant varieties, is used by Professor Edgar Allen and his co-workers at the Yale Medical School as a key to new knowledge on animal reproduction, and, incidentally, on the ever-present problem of cancer. He told of some of his researches at the North Truro meeting of the Society for the Study of Growth.

Colchicine is of value in this work, Professor Allen explained, because it "freezes" dividing cells in exactly the condition in which it finds them. Thus he is able to give supplemental doses of sex hormones to female rats and other small laboratory animals, follow that with injections of colchicine, and then kill and dissect his specimens at various time intervals, getting a series of clear pictures of just what has been going on.

One of the things he has found out is that the female sex gland at each reproductive cycle starts to develop several times as many eggs as it finally discharges. As many as four fifths of those that start never finish. The colchicine technique shows up the unsuccessful ones, some growing abnormally inside, others developing abnormally outside; the few that are "chosen" maintaining an even developmental balance throughout. Nobody knows as yet why this happens. If the secret is eventually discovered it will obviously help in giving an understanding of comparative fertility in animals, and thus be of importance in both medicine and farm animal production.

Another discovery made with the aid of colchicine settles the old question of what happens during gestation to the muscles of the uterus, which cradle the young during the pre-birth period. Professor Allen has definitely demonstrated that these muscles undergo great cell mul-

tiplication and growth. After birth, there must be a great dying off and resorption of this emergency tissue, returning the muscles to their ordinary size.

Warning has often been issued by physicians against too free use of female sex hormones in medicine, lest their highly active growth-promoting compounds run growth out of bounds into the wild, anarchic growth that is cancer. Professor Allen and his colleague, Dr. William Gardner, have found just that, as a result of long-continued stimulation of growth in the sex organs with hormones. He has slides showing the first experimentally induced cases of cervical cancer in animals. Such cancers can not be induced in all his animals, but they do arise in from fifty to sixty-two per cent. of the mice that survive hormone treatment for more than one year. Susceptibility seems to be partly a matter of heredity.

MUSCLE FIBERS

RUSSIANS are aiding American efforts in other fields than those of war. Basic research in life science, carried out at the Academy of Sciences in Moscow while Nazi bombers were nightly roaring over the city, has thrown new light on a problem under investigation by a biochemist working in New York. Dr. Kurt G. Stern, of the Overly Biochemical Research Foundation, at the annual symposium of the Society for the Study of Growth, reviewed present knowledge of how molecules grow and multiply.

Academician W. A. Engelhardt and his Moscow colleagues were trying to find out how muscle fibers used food energy in the contraction. The picture they got was one of a complex phosphorus compound, adenylypyrophosphate, being split by the contractile muscle protein. When they made an artificial model of muscle by spinning threads of muscle protein, much as artificial silk is spun, and immersed it in a solution of the energy rich phosphorus compound, the fibers lengthened. They see a muscle as a spring put under tension in this way. When a suitable stimulus is applied the coil snaps back, the muscle contracts.

This picture, said Dr. Stern, helped him considerably in his efforts to understand the growth and reproduction of the protein-like molecules of disease-causing viruses, those ultramicroscopic particles about which there is at present much dispute as to whether or not they are alive. Whether they are alive or not, Dr. Stern believes, is of less importance than a determination of the means by which they grow at the expense of their host cells.

One of the things that probably happens when virus particles multiply is a piracy of energy from the same kind of phosphorus compound in the host cell by the parasitic virus particles. It is suggested therefore that virus growth depends on the appropriation of the host cell's energy supply as well as its building material. This would explain, among other things, why viruses are always parasitic, feeding only on living cells of plants and animals, and are never found as scavengers, feeding on the dead. Dead things might yield them building materials, but could offer no substances actively engaged in the transfer of life energy.—FRANK THONE.

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This rigorous, systematic treatment of modern photographic principles and processes covers lens optics, monochrome and color reproduction. Important printing processes are also treated, including the bichromated colloid methods. The material on color photography and reproduction is particularly inclusive. Criteria are developed for appraising the quality of color reproduction, the effectiveness of modern masking methods is discussed, and the new Kodacolor process described. The book is well illustrated and includes a number of color plates.

To be ready in October. \$4.50 (probable)

MACMILLAN—NEW YORK

PUBLICATION OF A "LOST" BOOK

A GREAT encyclopedic work on the wonders of the New World, written by Fray Antonio Vázquez de Espinosa, long reckoned as one of the most famous of "lost books," has finally been published by the Smithsonian Institution. It really was lost for a long time—lost where it is hardest of all to find any particular book because it is surrounded by thousands of other books: lost in a great library. In this particular case it was the Vatican Library, where an American scholar, Dr. Charles Upson Clark, finally discovered the manuscript and the partially printed sections. It is at last available, in English translation, for anthropologists, historians, geographers and scholars of all angles of interest.

Fray Antonio, a very energetic, inquiring sort of person, spent the greater part of his adult life in South and Central America. He recorded everything he saw, quizzed missionaries, soldiers, officials, traders, and made judicious notes of all he learned. At last growing old, he went back home to write up and publish his tremendous accumulation of information. Unfortunately he died before much of his work got into print, and for three centuries scholars have known of his writings mainly through quotations by his contemporaries.

Fray Antonio made some mistakes in his accounts, especially where he was depending on the testimony of others. Like everyone else of his time, he describes California (which means Lower California) as an island. He also speculates on the location of the fabulous El Dorado, which has never achieved actual location on a map.

The book gives a rather good description of the American buffalo or bison, as "woolly, humpbacked cattle with two short horns twisted backward. . . . They are very ugly and wild. The wool on their chests in front is long and curly. They make excellent rugs from their hides." He also had a good word to say for the Indians of what is now the southwestern United States, speaking of them as "very intelligent and well-governed. They wear cotton clothing and antelope skins which are well decorated. As jewelry they wear turquoises."

ITEMS

CONTOUR plowing, following the natural levels of the land to conserve moisture and check soil erosion, is becoming increasingly popular on American farms. Until now, however, the old straight-line fences of the old square-shaped fields have remained, in many instances interfering with the curved path of the cultivating machinery and increasing the number of troublesome "point rows" necessary. Some farmers, according to the U. S. Department of Agriculture, have recently begun to reset their fences, so that field boundaries go with the contour plow lines. This not only abates the "point-row" difficulty, but furnishes a permanent guide to cultivation. Plant growth in the fence row also serves as a further water conserver and soil anchor.

NAVIGATION charts of the U. S. Navy will now appear in new colors. Studies conducted by the Navy show that the man who steps from a dark deck to a chart room illuminated by white or blue light will require from ten

minutes to half an hour after he returns to the darkness before his eyes again become dark-adapted. This time required before he is able to see well in the dark is reduced to only a few seconds if the light used is red instead of blue. But when red lights and red goggles were introduced as a result of this study, it was found that the old colors on the navigation charts could no longer be distinguished. The buff color used for land, the orange which indicated navigational lights, and the red lines are all invisible under red lighting. So in future charts, the land areas will be gray, the lights will be magenta, and purple will be substituted for red.

AN all-time low record for smallpox in the United States was set in 1941, but health authorities of the Metropolitan Life Insurance Company warn against overconfidence about the smallpox situation. An increase in smallpox cases can confidently be predicted, they point out, if people generally get the false notion that vaccination against smallpox can be dispensed with. In that case the growing number of unprotected persons will provide a new fertile field for a resurgence of the disease. The shift, because of the war, of thousands of families of war workers from smallpox areas to cities previously free of smallpox may lead to outbreaks in these cities. The best protection against this danger is a wide-spread and vigorous campaign for vaccination, including revaccination of adults.

THE electron microscope now promises to show what happens to an individual disease germ when it is attacked by a germ-killing agent such as bichloride of mercury. The first studies along this line are reported by Dr. Stuart Mudd, of the University of Pennsylvania, and Dr. Thomas F. Anderson, of the RCA Manufacturing Company, in the *Journal of Experimental Medicine* for July. They find that when a typhoid fever germ is mixed with silver nitrate, the flagella which serve the germ as propellers are completely destroyed. The protoplasm, which is the very life of the cell, is stained black, but the wall of the cell is apparently unaffected. The entire germ is very much smaller, as if shrunk. When the typhoid fever germ is mixed with lead acetate, however, the flagella, though darkened, are not destroyed. The germ swells and its protoplasm escapes its wall to form a halo around it. Differences in action of lead, silver, nickel and mercury salts were also observed on cholera and dysentery germs and on a microorganism called *Fusobacterium*.

CHEMICAL magic with plants, written so that the ordinary garden variety of gardener can work it, is described by two U. S. Department of Agriculture plant physiologists, Dr. John W. Mitchell and Ruby R. Rice, in a new department publication, "Plant-Growth Regulators." It tells how growth-promoting substances, indole acetic acid and related chemical compounds, can be used to insure the rooting of slips and cuttings, to keep trees from dropping their fruit before it is ripe, to make holly berries form from unpollinated flowers, to induce the production of seedless tomatoes, and a number of other useful things that plants are unlikely to do if left to their own devices.

STANDARD TEXTS

ACOUSTICS

By Alexander Wood, D.Sc., Cambridge;
University Lecturer in Experimental
Physics.

1941. 575 pages. 310 illustrations. Many
tables and diagrams. \$7.00

HEAT AND THERMODYNAMICS

By J. K. Roberts, Ph.D. (Cantab.), Univ.
of Cambridge.

1940. 3rd complete revised edition. 488
pages. 158 illustrations. 20 x 20 chart.
\$6.50

PHYSICAL CHEMISTRY OF HIGH POLYMERIC SYSTEMS

By H. Mark, Professor of Organic Chem-
istry, Polytechnic Institute of Brooklyn.

Translated from the German by K. Sinclair
and J. E. Woods.

HIGH POLYMERS SERIES, Volume II
1940. 353 pages. 99 illustrations. \$6.50

NATURAL AND SYNTHETIC HIGH POLYMERS

A text book and reference book for chemists and
biologists.

By Kurt H. Meyer, Professor of Organic
Chemistry, Univ. of Geneva, Switzerland.

Translated by L. E. R. Picken.

HIGH POLYMERS SERIES, Volume IV
1942. 708 pages. 180 illustrations. \$11.00

ORGANIC CHEMISTRY

By Paul Karrer, Professor of Chemistry,
Univ. of Zurich.

Translated from the 6th German edition by
A. J. Mee, Glasgow Academy.

1938. 900 pages. Illustrated. \$11.00

EPHRAIM'S INORGANIC CHEMISTRY

By P. C. L. Thorne and A. M. Ward,
County Technical College, Guilford, En-
gland.

1940. 3rd revised and enlarged English
edition. 924 pages. 98 illustrations.
\$8.00

DIFFERENTIAL AND INTEGRAL CALCULUS

By R. Courant, New York Univ.

Translated by J. E. McShane, Univ. of
Virginia.

Volume I, 1938. New revised edition. 630
pages. 136 illustrations. \$5.00

Volume II, 1936. 692 pages. 111 illus-
trations. \$7.00

OUTLINES OF STRUCTURAL GEOLOGY

By E. Sherbon Hills, Lecturer in Geology
in the Univ. of Melbourne, Melbourne,
Australia.

1940. 182 pages. 105 illustrations. 4
plates. \$2.25

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SCIENCE NEWS

Science Service, Washington, D. C.

THE BUFFALO MEETING OF THE AMERICAN CHEMICAL SOCIETY

CHEMISTRY'S contributions to the American war effort was the keynote of the annual fall meeting of the American Chemical Society which opened last Monday, with 4,000 of the country's leading chemists gathered to hear and discuss something over 400 papers setting forth the gist of the year's progress.

"National Survival Through Science" was the subject of the presidential address, delivered Monday evening by Professor Harry N. Holmes, veteran of the Oberlin College faculty. More particular treatment of special topics at the daily sessions included papers on such war-important subjects as synthetic rubber, gasoline and oil, alloy steels, dehydrated foods, synthetic plastics, potash and the newer chemical drugs.

There were many men well known in industry and public affairs as well as in the field of chemistry among the participants in the program. The list included Lieutenant General William S. Knudsen; Dr. Charles M. A. Stine, vice-president of E. I. du Pont de Nemours and Company; Dr. Willard H. Dow, president of the Dow Chemical Company; Dr. Edward R. Weidlein, director of the Mellon Institute in Pittsburgh, and many others.

Chemistry's equivalents of Distinguished Service Medals were awarded at the meeting. The Francis P. Garvan Gold Medal, honoring women in chemistry, was presented to Dr. Florence B. Seibert, of the Henry Phipps Institute of the University of Pennsylvania, for her distinguished work on the chemistry of tuberculosis. For contributions in the field of protein chemistry, Dr. John L. Oncley, of the Harvard Medical School, will receive the \$1,000 American Chemical Society Prize in Pure Chemistry, given annually for outstanding research by a man or woman less than thirty-six years old.

One feature that usually marks meetings of the American Chemical Society was this year conspicuously absent: there were no inspection trips to industrial plants where chemical methods are in use. This year, and for the duration, such visits are impossible because of wartime restrictions that bar even scientists from factories where production is being pushed to the utmost and even the visits of colleagues would be a time-losing distraction. Instead, parties of the chemists and their wives made trips to nearby Niagara Falls.

VANADIUM, strengthener of steel for war, is now being extracted by a new process from Idaho phosphate rock used in fertilizer manufacture. It is estimated that half a million tons of vanadium can be recovered from the 5,700,000,000 tons of phosphate rock in sight in this deposit. The extraction process was described before the meeting of the society by Dr. J. Perry Morgan, chemical engineer of the Standard Oil Company of New Jersey, who developed it under the direction of Professor Arthur W. Hixson, of Columbia University.

The phosphate rock is first treated with sulfuric acid,

the solution concentrated by evaporation, and then treated with nitric acid. The vanadium is precipitated as vanadyl phosphate, and the phosphoric acid is filtered off to be used in the making of fertilizer. The vanadyl phosphate is subjected first to live steam, then treated with ammonia gas and ammonium nitrate, which converts it into ammonium vanadate. The ammonium is driven off as ammonia gas by heat, leaving a residue of vanadium pentoxide, which is the form in which vanadium is supplied to the steel industry.

Vanadium is a prime toughener of steel. It is a requisite in the manufacture of armor plate, crankshafts, axles and piston rods, and other steels needed where heavy punishment will be encountered. About four pounds are added to each ton of steel, as a rule.

American steel makers have depended mainly on one mine in Peru for their vanadium supply, with certain additional amounts from Africa. However, war demands for steel have so greatly increased the quantity of vanadium needed that new sources had to be sought. There are other deposits of vanadium-containing minerals in the United States, but unfortunately they are badly scattered. However, the total supply of the vital alloy metal in this country will probably amount to several million tons, if emergency requires complete exploitation.

DEHYDRATING vegetables is not simply a matter of peeling and slicing them and tossing them into the drier. There are a lot of tricks to the trade, and ignorance or neglect of them will produce the inferior products that gave dehydration such a black eye during World War I and delayed its progress by a decade or more. Dr. W. V. Cruess, of the University of California, told of some of the things that must be done if dehydrated vegetables are to be really good.

First of all, the vegetables must be garden-fresh. Keeping them for any length of time results in a loss of vitamin C, he said. Then they must be blanched, that is, thoroughly scalded in hot steam, to stop the action of their own enzymes which will spoil both quality and color if they are allowed to continue their activities within the cells. The practical dehydrator has to know certain necessary facts about plant physiology, and apply them. Dehydration temperatures can be high at the beginning, while the vegetables still have full moisture content, because the water absorbs the heat. But near the end, the temperatures must be kept to a safe, low level.

Even after the job is finished, there are still troubles to contend with, Dr. Cruess told his listeners. Insects love dehydrated foods, and will chew through anything but metal or glass to get at them. They are highly absorbent toward atmospheric moisture, and likely to spoil in contact with oxygen; which again calls for special protective measures.

WHILE food dehydration is attracting great attention because the products can be so compactly shipped for

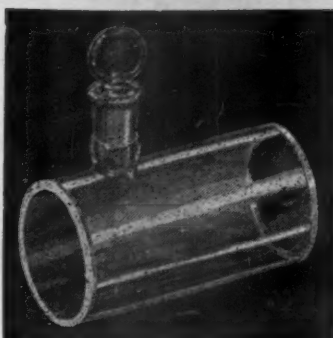


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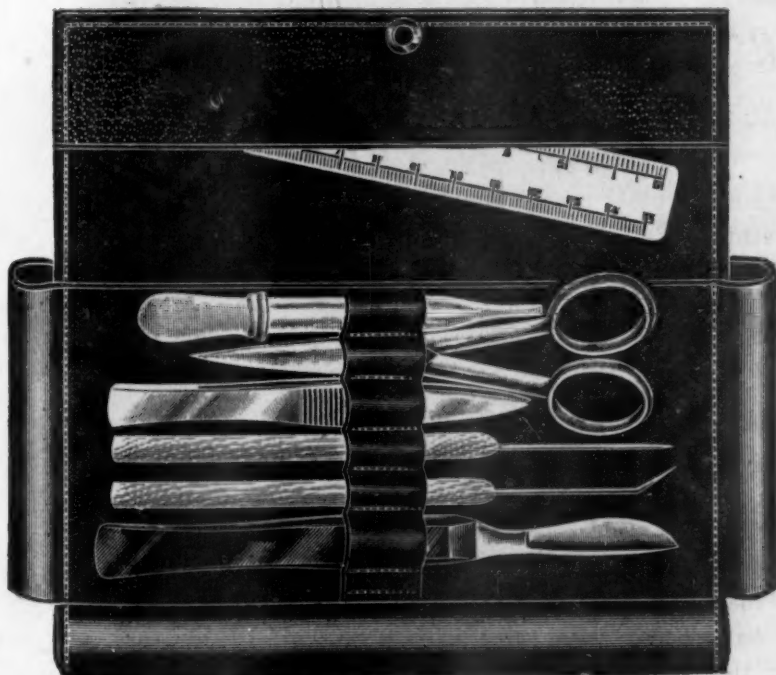
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overseas use, quick-freezing of fish, meat, fruits and vegetables for home consumption is not being neglected. Frozen fish is in such great demand, according to Domenic DeFelice, of the New York State Agricultural Experiment Station, that hitherto unused species have had to be added to haddock, flounder and other first favorites for filleting. The frozen berry industry in the Pacific Northwest has about reached its limit, but is expanding elsewhere in the country. Boned and packaged meats are being frozen in large quantities for Army use.

THE canning industry took a body blow when Jap aggression cut off hitherto abundant tin supplies, but canners are putting up a good fight to do their share toward national food conservation, was stated by E. J. Cameron of the National Canners Association. Electrolytic tinplate, which requires far less tin than the old method, and pretreated steel plate, which requires no tin at all, are coming into increasing use. Low-tin and tinless solders also are winning their way.

DRINKS as well as foods came in for attention. Dr. A. J. Liebmann and M. Rosenblatt, of the Schenley Distillers Corporation, told of researches on the chemistry of aging whiskey which they have been carrying on for five years, with an array of about 560 barrels of liquor as experimental material. All whiskey is colorless when it is first run into the barrel, they stated. It gains color, aroma and most of the other qualities prized by the proverbial "judge of good liquor" through long contact with the wood. Three things happen: (1) Extraction of substances from the wood; (2) oxidation of some of the original substances in the liquor and also the material extracted from the wood, and (3) reaction between the original substances and those from the wood.

THE postwar automobile will burn gasoline of 150 octane rating, and it will never be necessary for the filling station attendant to put more water in the radiator because the cooling system will be permanently sealed. When you get home from your ride, you'll put the car in a garage with plastic-and-plywood walls and a stainless steel roof.

Your house will be built of the same materials, strong yet so light that two men will be able to lift the whole wall of a room as they put it up.

These are items from a vision of the future presented in an address by Dr. Charles M. A. Stine, vice-president of E. I. du Pont de Nemours and Company. They aren't just dreams, he explained; the things actually exist now, at least on an experimental basis, but are at present absorbed into the war effort.

Other new accomplishments in scientific technology were listed by Dr. Stine: glass that is unbreakable, glass that will float, wood that won't burn, shoes that contain no leather, window screens without wire, machinery bearings not made of metal. Post-victory production of consumer's goods will reach heights undreamed of in prewar days, the speaker predicted. We have built an immense industry that turns out more light metal in a year than was formerly produced in a decade, with corresponding vol-

umes in such things as special steels, plastics, synthetic fabrics, fuels.

Having seen how abundantly we can produce for war, the American people will insist on abundance in time of peace, Dr. Stine forecast. Slums must be cleared away, he declared; the space they leave should not be filled with other buildings, but put to use as close-in airfields. Better nutrition for everyone, based on recent researches in food chemistry, is imperative for the maintenance of a population of high industrial productivity.

No doubt, some will become alarmed over the possible displacement of old materials and old industries. Changes of a drastic nature are inevitable, but they seldom result in the hardships that the timid predict. . . . Let our swords be mighty, and mighty indeed will be our plowshares.

MEATLESS days, even whole meatless months in an emergency, need have no nutritional terrors, if a supply of soybean, cottonseed or peanut flour is available, the American Chemical Society heard in a report by Theodore F. Zucker and Dr. Lois Zucker, of Columbia University. These flours, which are made from the seeds after the oil has been extracted, are very rich in protein and certain vitamins, so that they should prove highly valuable as additions to ordinary wheat flour, making bread a more nearly balanced diet. It is possible to make a meatless sandwich just by buttering two pieces of this mixed-flour bread and slapping them together. The "meat" is invisibly present, incorporated in the bread itself. Both soybean and cottonseed flours have distinctive tastes to which the eater needs to become accustomed. Cottonseed flour makes a yellower loaf than most of us are used to. On the other hand, it is very cheap—five cents a pound on the current market. Peanut flour offers less difficulty so far as taste is concerned, but its price is considerably higher.

Test batches of bread were made up out of various mixes of these seed flours with wheat flour and tried out on rats, which thrive very well on them, needing no other source of proteins. They also got sufficient quantities of two necessary vitamins, thiamin and riboflavin, from the seed flours.

ANOTHER by-product of agricultural industry that may find profitable use through chemical handling is bagasse, the woody waste left after the sugary sap has been crushed out of sugarcane. Professor Donald F. Othmer and George A. Fenstrom, of the Polytechnic Institute of Brooklyn, described their experiments with this material. From a ton of dry bagasse, heated in a dry still, they obtained 35 pounds of acetic acid, one and a third gallons of crude methanol (wood alcohol) and 750 pounds of charcoal. The acetic acid and methanol are in large demand as industrial solvents, and charcoal is a familiar domestic fuel in the warm lands where sugarcane is grown. The experimenters pressed it into briquets for marketing.

WORLD WAR I caught us short on potash, necessary alike for farm fertilizer and chemical manufactures. It isn't happening this time. That the pre-1914 German monopoly

of this important mineral has been broken by the development of an American potash industry, was pointed out by Dr. George R. Mansfield of the U. S. Geological Survey. At present, only the highest grade potash deposits in the West are being worked, but these alone would be enough to supply American needs for 200 years, at present rates of use. In addition there are large quantities of other potash minerals that are not profitable to exploit at present, but may be made so by future technical advances. How potash is helping the United States to win the war was outlined at the same symposium by Dr. J. W. Turrentine, of the American Potash Institute. With plenty of this highly important fertilizer element now available, farmers need not stint their fields as they had to during the first World War, but can use all they need. This means bigger crops from the same acreage, which in turn means more bread, more meat, more vegetable oils for ourselves and our allies.

If Nazis or Nips resort to polecat warfare and spray poison gases on the commissary stores, that doesn't necessarily mean that the troops will have to go hungry. Of course, mustard gas instead of mustard on your meat would make it unfit to eat—but if it is wrapped or packaged as well as most commodities are now-a-days it will still be good to eat after the covering has been decontaminated and removed. Do's and don't's or anti-gas protection for foods were reviewed by Dr. Sidney H. Katz, of the U. S. Chemical Warfare Service's main arsenal at Edgewood, Md. The most dangerous of so-called poison gases, from the food-contamination viewpoint, are not really gases at all but finely atomized liquid sprays. These cling to anything they touch, and unless recontaminated will remain dangerous for days. Decontamination is not a job for just any one; it must be carried on under the direction of an officer trained for this particular job. The best protection against chemical contamination, the speaker stated, is afforded by the most conventional of food packaging—tin cans and glass jars. Cellophane is very good for excluding the insidious poisons, especially when the package seams are well sealed. Tin foil and aluminum foil wrappings also are effective, but only if tightly applied. Simple paper or cloth bags are bad, but several layers of either paper or cloth give fair protection. Corrugated cardboard is good, especially if it has been given a glazed coating. Natural rubber is not as effective against war chemicals as some of the synthetic rubbers.

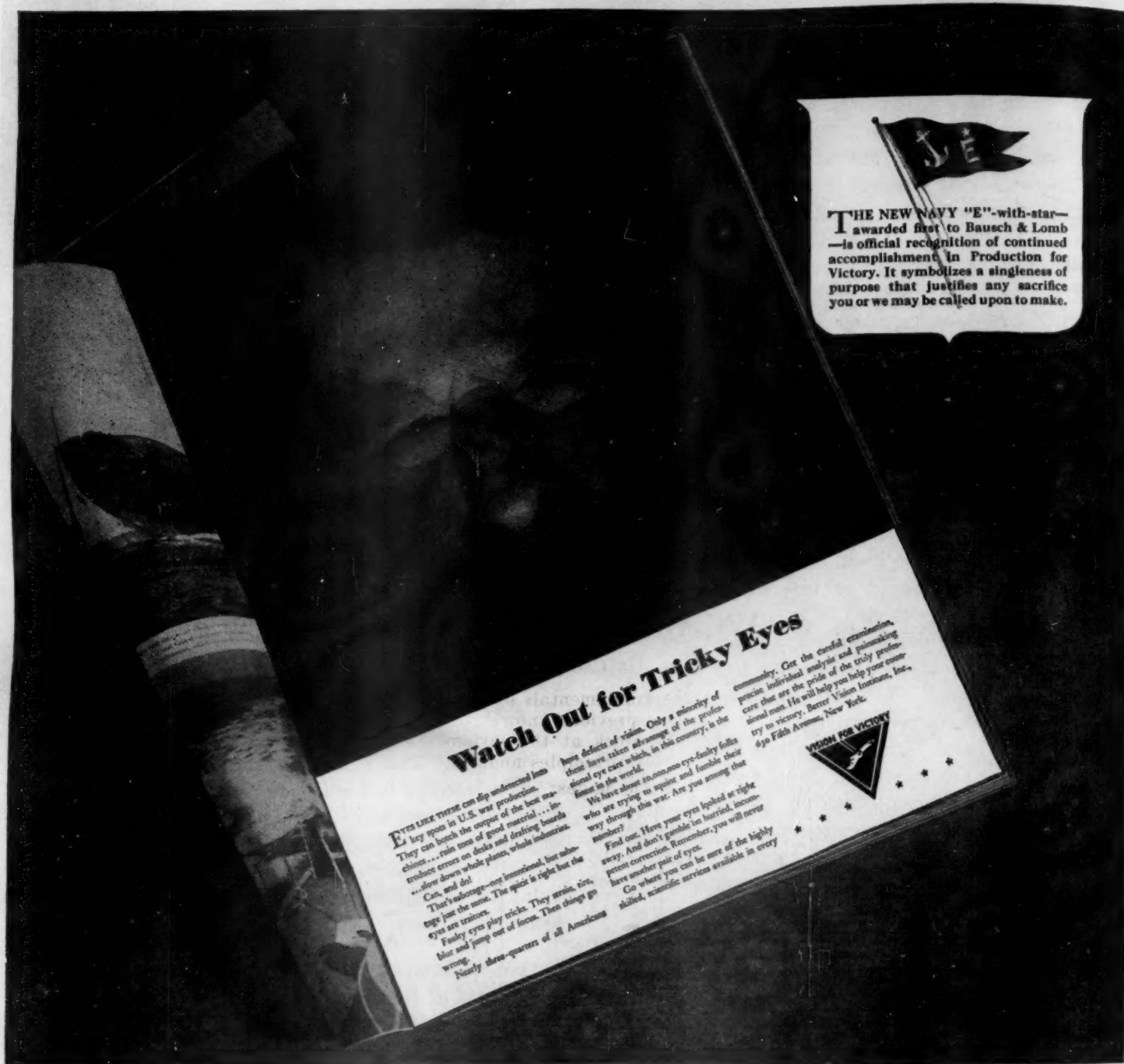
CHEAPER riboflavin (vitamin B₂) for bread enrichment is the prospect held forth by Dr. Jonas Kamlet, of Miles Laboratories, Inc., New York City. Ribose, a special sugar which is the only raw material from which riboflavin can be elaborated, is produced by a strain of yeast that is fed on waste sulfite liquor from paper-pulp mills, one of the most troublesome of all industrial wastes. The process was developed first at the National Bureau of Standards, Dr. Kamlet stated, and the first commercial installations are two plants set up in Canada by a Swedish engineer, G. Heijkskjold. Similar plants will be built in the United States after the war.


DYES made directly from soft coal, instead of the time-honored coal tar, were described before the meeting by Dr. H. B. Charnbury, of the Pennsylvania State College. The coal is first treated with nitric acid, to obtain a foundation material which is then treated with organic acids and inorganic alkalis to produce the dyes themselves. These direct-from-coal dyes were tried by Dr. Charnbury on animal fibers like silk and wool, vegetable fibers like cotton and linen, and synthetics like rayon and nylon, with successful results.

PHYSICS supplemented chemistry in a search for causes of the stretchy, bouncy behavior of rubber when a group of physicists from Notre Dame University presented three papers before their chemical colleagues. The chemists remembered the classic contributions of a former colleague from the same university, the late Father Nieuwland, pioneer in the creation of synthetic rubber, as they listened to the presentations of Dr. Eugene Guth, Dr. S. L. Dart, Dr. R. L. Anthony and Dr. L. E. Peterson, together with Dr. H. M. James, of Purdue University. The picture they gave was one of a curious substance that has some of the behavior features of a solid, some of a liquid, and some even of a gas. Explanation is to be found, the speakers suggested, in the shape of the individual rubber molecules, which are long, spiral, wormlike affairs that hook their coils together like tangled springs. One of the gas-like properties of rubber is its curious sudden rise in temperature when it is stretched, and its cooling when it contracts. This can be tested by any one, merely by touching the lips to a quickly stretched rubber band. The Notre Dame scientists have made a quantitative study of this strange temperature effect in rubber, with sensitive scientific instruments. Their data are expected to be of value in the future development of both natural and synthetic rubbers.

COAL is commonly thought of primarily as food for the mouths of factory furnaces, rather than as a material of great benefit to farmers—beyond keeping their houses warm, perhaps. But that farmers are beneficiaries of the mining and coal-processing industries in a number of ways, was pointed out by Dr. Hubert G. Guy, of the Koppers Company, Pittsburgh. Ammonia compounds, by-products of the coke industry, have become one of the principal sources of fertilizer nitrogen. Naphthalene, a by-product of coal carbonization, is widely used to combat several kinds of insect pests, as well as in preserving stored hides. Synthetic plant hormones, also originating from coal, hasten the formation of roots on cuttings and are sprayed on orchard trees to prevent premature dropping fruit. Other coal products are used as food colorings, wood preservatives, disinfectants and parasite killers.

ANTHRACITE coal is coming into wide-spread use for filtering city water supplies, replacing the long-used sand beds, according to Dr. Homer G. Turner, of the Anthracite Equipment Corporation, New York. During the past seven years anthracite for filter use has been shipped to every state in the Union and to Alaska, Canada, South America, England, Australia and Iran.






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SCIENCE NEWS

Science Service, Washington, D. C.

ALTERNATING CURRENTS

THE story of a pioneer in alternating currents of electricity was told at Vancouver, B. C., at the convention of the American Institute of Electrical Engineers by the pioneer himself, Dr. Frederick Bedell, now consulting physicist of Pasadena, Calif.

The present occasion is the fiftieth anniversary of the first paper presented to the institute by Dr. Bedell and his collaborator, A. C. Crehore, on alternating currents, which cleared up for the first time misunderstandings and confusions in this field. It has been called a "pioneer paper" and "a classic in its field."

Dr. Bedell is the inventor of oscilloscope with linear time axis, which pictures the alternating current wave form on a fluorescent screen. It is now an indispensable instrument in every field including telephony and television where alternating, fluctuating or transient currents are involved. His pioneer research and inventions in bone conduction have enabled many people to hear who never heard before.

For these two outstanding achievements, Dr. Bedell was honored in 1940 with the award of Modern Pioneer on the American Frontier of Industry by the National Association of Manufacturers. "In 1890," Dr. Bedell said, "alternating current was just plain freak; it did not follow Ohm's law and 'clogged' itself in its circuits." Nobody understood it. Everyone was afraid of it.

The first installation in 1886 put 500 volts on the transmission line and then stepped it down to 100 volts by the then newly-born transformer. The length of the line was 4,000 feet. But electricians said, according to Dr. Bedell, "If a high potential primary circuit of 500 volts or more were used to distribute electricity throughout a community, there was grave fire and life danger." A few years later a bill was introduced in the Virginia legislature to limit alternating current voltage to 200, alternating current being considered more deadly than direct. This is a far cry, Dr. Bedell remarked, from the 287,500 volts of the Boulder Dam plant of to-day.

The chief worry of engineers in the early nineties was wave form "whatever that might be." They knew from the principles of sound that a pure tone is given by a "sine" wave, that any departure from this form means the presence of harmonics which may have 2, 3, 4, or many more times the frequency of the fundamental note. Such harmonics in an alternating current wave could be dangerous, for the inductive effects increase with the frequency. If the circuit happens to be in tune with any one of them, the voltage may reach very high peaks and fireworks on the switchboard may result—and often did.

But what is a tuned circuit? Why is the current "clogged" in some circuits, while the voltage jumps to distressing heights in others? The answers to these and many other questions were given in the 1892 paper of Bedell and Crehore. Its 72 pages contained the first clear and mathematically correct theory of the flow of alternating currents both in transient as well as in steady

conditions. Vector methods and circle diagrams, now so common, were introduced, and the first use was made of complex quantities. Later that same year, the contents of this paper were incorporated in a book, "Alternating Currents," by Bedell and Crehore, which long served as a standard text-book, and even to-day is an excellent introduction. The same can be said of Bedell's "Principles of the Transformer," published in 1896.

But to apply the theory, a knowledge of the wave form was necessary, and no instruments existed that could determine the form of an electric wave that lasted 1/20th of a second or less. From 1893 on Dr. Bedell and others devoted themselves to this task. Various mechanical and electrical methods were devised. The most successful of these was the Dudell oscillograph about 1900. This consisted of a very light element suspended in a magnetic field produced by the current to be investigated. This element moves back and forth in tune to the alternations of the field, and makes it possible to photograph the curve of the wave form on a moving film. This instrument is still useful for low frequencies. But however light the suspended element, it still has weight, and its oscillations lag behind those of the field, and above a certain frequency cease altogether. For high frequencies a weightless vibrator was needed. This came with Dr. Bedell's cathode ray oscilloscope in 1927. The vibrator is an electron stream which will follow the most rapid oscillations even up to the ultra-high frequencies now used in radio. Cathode ray oscilloscopes were not new, but they had lacked a reliable time axis. They only produced a figure on the screen from which the wave form could be mathematically deduced. Dr. Bedell's invention remedied this defect. The wave form known, the harmonics present could be determined, and the theory showed how to suppress them or at least to reduce them to harmless dimensions.

The amounts that could be safely allowed were also determined. In 1915, Dr. Bedell as chairman of the subcommittee on wave form of the Standards Committee began setting up wave form standards to make alternating current machinery safe. Penalties were imposed on the different harmonics according to their frequencies, in this way, as Dr. Bedell put it, making the penalty fit the crime.

With these standards, which have been revised from time to time, fireworks have disappeared from the switchboards and elsewhere. The wild waves have been tamed, and no one is now afraid of alternating currents.

THE EXPECTATION OF LIFE

FANTASTIC as it may sound, we are outliving our expectation of life. Statisticians for the Metropolitan Life Insurance Company point out that men and women born in 1876, for example, had an expectation of life when they were born of 41.4 and 44.6 years, respectively, on a statistical basis. But the average length of life for men and women born that year turned out to be 46.3 years

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for men and 50.6 years for the women. The figures are for England and Wales, but the principle applies in this country as well. This extra lease on life has been gained because of the advances of science and the standards of living.

The United States to-day has 2,900,000 more potential soldiers, men between 20 to 44 years old, than it would have had if it had not been for these life-saving improvements.

Many a man alive to-day knows that he owes his life to an operation or medical treatment—the sulfa drugs or insulin, for example—which has been developed during his lifetime. Many thousands of others owe their lives more indirectly to the advances of science. Of the 900,000 men and women aged 65 years alive in the United States to-day, 300,000 owe their lives to such advances. If conditions prevailing at their birth had continued, those 300,000 would not be alive.

The term “expectation of life” is not always used in its exact sense, the life insurance statisticians point out. “Strictly speaking,” they state, “the expectation of life at any age is the prospective average number of years of life remaining to persons of that age, provided that the death rates at each age remained constant at their prevailing levels. Thus if we say that the expectation of life for a white male 10 years old in 1940 was 57 years, we mean that the members of the large group of boys of age 10 in that year would, on an average, survive 57 years, if the death rates at each age of life remained unchanged as of 1940.”

CASES OF POISONING IN WAR PLANTS

THAT tetryl, chemical relative of TNT, is producing thousands of cases of poisoning in war plants, is reported by the *Journal* of the American Medical Association.

As production of explosives for the armed forces goes into high gear, an increasing number of poisoning cases are expected—odd cases of sickness with which the medical profession has been unfamiliar in peace-time practice. Symptoms usually occur after the second or third week of exposure. They usually consist of loss of appetite and nausea, coughing or sneezing, nosebleed, and—most significant of all—a characteristic inflammation of the skin. Anemia is also present in a good many cases. Yellow coloration of the skin of these war workers is not a symptom, but merely a staining of the skin.

Observations made on 1,258 cases by Dr. Leon J. Witkowski, Dr. C. N. Fischer and Howard D. Murdock, of Chicago, reported in the *Journal*, emphasize that the reactions are not only local, but affect the system as well. Of the war plants investigated where tetryl is processed about 23 per cent. of the workers were affected.

Although many workers were found to eventually develop a tolerance to the explosive after a number of weeks, the illness is not to be neglected. Physicians have already devised measures to protect health and avoid lost time in the war effort.

The physicians making the report emphasize the necessity of controlling the tetryl dust found in the plant atmosphere. This may be aided by conducting certain operations in small closed rooms separated from the rest

of the plant. Cleanliness, ventilation, and temperature below 72 degrees Fahrenheit, are also important. Dietary measures, which have been recommended by some, consisting of taking milk or vitamin C, do not appear to be of great value to date. Lotions and ointments have been successfully used by physicians to allay the skin inflammation and the anemia is controlled by standard methods of treatment.

Use of great quantities of tetryl in certain defense areas has introduced a new occupational hazard—a challenge that can be met, when symptoms are first noticed, by cooperation of the workers and industrial medicine.

BUTYL RUBBER TIRES

BUTYL rubber tires in actual tests on New Jersey highways have shown a life of 20,000 miles if kept below a maximum of 40 miles an hour, was reported by J. P. Haworth and F. P. Baldwin, of the Esso Laboratories, before the Buffalo meeting of the American Chemical Society.

Some plants for the production of this type of rubber are already in production. Others are under construction. By a year from this fall the total production of butyl rubber will reach an annual rate of 130,000 tons.

Possibilities of “tailor-made” rubber for the different parts of a tire were pointed out. In the average light car tire, weighing about 12 pounds, only about four pounds is in the conspicuous part, the tread. Requirements for tread are different from those of side wall, and these in turn differ from those of carcass and inner tube. Synthetic rubbers can be given properties to suit the uses to which they will be put, which is not possible with natural rubber.

Perbunan, a highly specialized kind of synthetic rubber made of butadiene and acrylonitrile, was described by three other chemists of the Esso Laboratories, R. A. Moll, R. M. Howlett and D. J. Buckley. Acrylonitrile, a derivative of ethylene, comes, like butadiene, from oil and natural gas. One of its ingredients, hydrocyanic acid, can also be manufactured out of natural gas plus nitrogen from the air.

Perbunan's special claim to consideration is its high resistance to oil and gasoline, which makes it well adapted for use in self-sealing tanks for fighter planes, linings for filling-station hose, gaskets for oil pumps, and any other jobs involving exposure to oil.

It is also highly resistant to wear and quite resilient. This would make it an excellent tire rubber; but it is difficult to handle in manufacturing processes, so that its cost is high—somewhere between two and three times that of natural rubber. It should, however, make excellent tread blocks for tanks, a use that does not involve so much hand work as the preparation of tires.—FRANK THONE.

ITEMS

THE volcanic structure of the Galapagos Islands off the coast of Ecuador, now occupied by American troops, provides natural harbors. In spite of its name, Wreck Harbor, on the coast of Indefatigable Island, is said by geologists to be a safe and excellent approach to the shore.

Before the Galapagos acquired vital importance as a Pacific base for protection of the Panama Canal, they had long been an historic spot frequented by zoologists. It was here that Charles Darwin's famous idea occurred to him, like Newton and the apple. Only in Darwin's case, it was the sight of strange, unique forms of plant and animal life—giant turtles and uncouth sea lizards—which crystallized his theories of evolution through natural selection. Sixteenth-century Spanish navigators were so impressed by these giant turtles, often four feet long, that they gave the islands the Spanish name for "tortoise." Since the nearest relative to the Galapagos tortoise is a fossil found in Cuba, geologists believe the islands were once part of Central America, even though they are now 500 miles west of Ecuador, in South America. They are composed of twelve large, and several hundred small, islands, with many volcanoes still actively erupting on their shores.

SMOKELESS powder and synthetic rubber can be made cheaply and abundantly, using alcohol from watery wastes now poured down the sewer. The economics of the method, which by-passes the expensive distillation process, were explained before the Buffalo meeting of the American Chemical Society by Dr. Donald F. Othmer and Dr. R. L. Ratcliffe, of the Polytechnic Institute of Brooklyn. Waste liquors from paper mills and other industrial plants, as well as sawdust, straw, cornstalks and other agricultural wastes, contain sugars capable of being fermented into alcohol. But the solutions are so thin and

watery that the fuel needed for distillation is worth more than the alcohol that could be obtained. Key to the riddle is fusel oil. Fusel oil dissolves alcohol but will not mix with water. So this toper's enemy is put to work getting the alcohol out of the watery wastes. Subsequently a chemical divorce between the alcohol and the fusel oil is arranged. A similar use of fusel oil can be made in getting acetone and other valuable industrial solvents out of solutions until now considered too thin to be profitably worked.

HOPE of controlling at least to some extent future influenza epidemics that may add to the horrors of war appears in a report to the American Medical Association by Dr. Joseph Stokes, Jr., and Dr. Werner Henle, of the University of Pennsylvania Medical School. A vaccine protected 43 out of 44 boys who were directly exposed to influenza. They inhaled through aviation oxygen masks a vapor of fluid from hen's eggs that contained a strain of influenza A virus. These germs were freshly isolated from a baby who had died with an overwhelming influenza infection. But only one boy caught the disease. Of 28 unvaccinated boys who breathed this same influenza germ-laden vapor, ten had attacks of influenza. The vaccine that gave such striking protection might not be able to stop an epidemic of influenza, even if it were possible to vaccinate the entire population. The vaccine protects against influenza A but there are other types of influenza that occur in epidemics against which the vaccine could not give protection.

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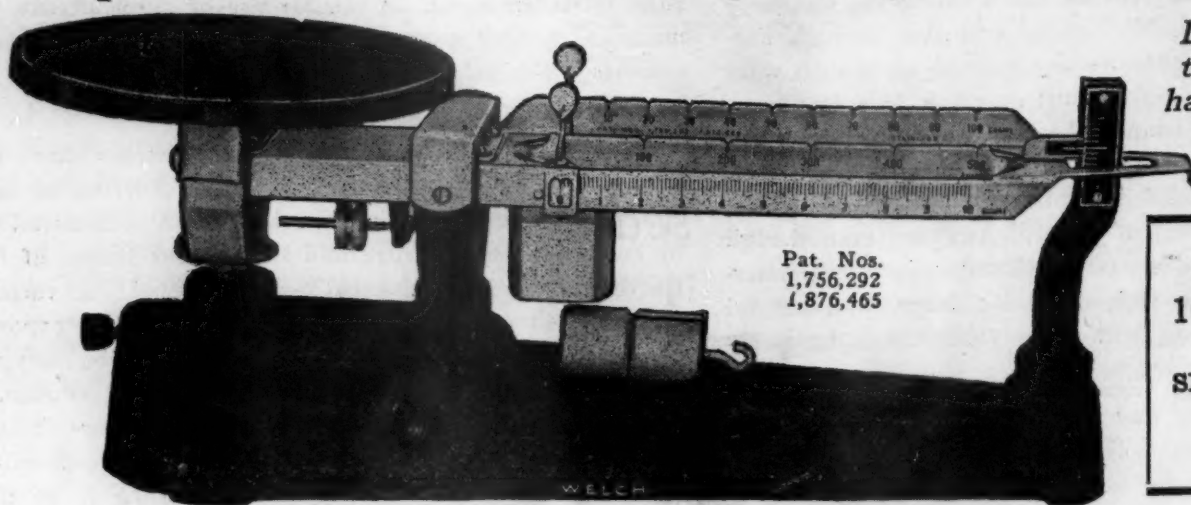
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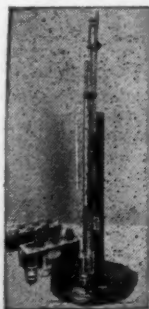
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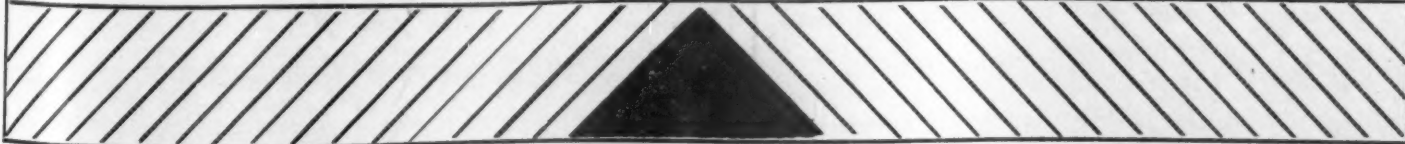
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SCIENCE NEWS

Science Service, Washington, D. C.

AN EXPLODING STAR IN CYGNUS

THE first nova or exploding star to appear in many months has been discovered in the constellation of Cygnus by Dr. Fritz Zwicky observing from Mt. Palomar, Calif. Observatories all over the world have begun observations upon the remarkable changes in this star's spectrum which will contribute to the knowledge of stellar structure and of atomic structure as well.

Not quite bright enough to be seen with the unaided eye, the nova now at eighth magnitude is probably as bright as it ever will get. Inspection of astronomical photographs at Harvard Observatory show that it had been photographed more than fifty times since June 8 when it was of about tenth magnitude.

Dr. Harlow Shapley, director of Harvard Observatory, stated that "It is likely that the nova reached its explosive maximum in early spring when too near the sun for discovery. During this summer it has been oscillating between the seventh and eleventh magnitudes. Ultimately it will fade away. Its distance is probably greater than a thousand light years."

Dr. Walter Adams, director of Mt. Wilson Observatory, reported the discovery to Harvard Observatory, whence the news was distributed by radio and telegraph to observatories both in the Americas and in Europe and Asia. Lund Observatory in Sweden relayed the information to observatories in both United Nations and Axis countries.

The spectrum of the nova shows bright bands with multiple absorption components. A complete curve of the light variations is being prepared from the Harvard photographs.

THE SCARCITY OF PHYSICISTS

ONE good physicist is bred per year per million inhabitants.

This estimate, made by Sir Lawrence Bragg, of Cavendish Laboratory, Cambridge, England, was based on the number of physicists turned out annually by the British universities, and is confirmed by the Central Register of the Royal Society, which corresponds to our National Roster. At the beginning of the war, the British had listed 1,200 physicists in a population of 45,000,000. Assuming an average working life of thirty years, this comes also to about one per million per year.

A survey made in the United States in connection with the National Roster of Scientific and Specialized Personnel shows that one good physicist in a million men applies to the U. S. A., too.

This ranks the physicist among the scarcest of war "materials." The demand in both England and America exceeds the supply, and the universities have been pressed to train as many men as possible to fill the gap. The physicist, like the poet, is born and not made, an editorial in *Nature* contends. He can not be made on demand by any system of training. However, the British editorial argues, Sir Lawrence Bragg's definition of a good physicist as "a man capable of independent

thought, with a flair for his subject," has set the standard too high. Many of the tasks for which physicists are required can be very adequately performed by men and women less gifted.

There has been a very substantial increase in the size of the physics classes in British universities and colleges. While this may not add materially to the numbers of "good physicists" it will add substantially to the numbers available for the more routine but no less important posts for which originality of a high order is not necessary. And this will enable the strictly limited number of men with a real flair for research to be assigned to the tasks that they alone can do.

THE TREATMENT OF CANCER WITH X-RAYS

THE experimental treatment of cancer with x-rays generated by 3,000,000 volts of energy was described at the Chicago meeting of the American Roentgen Ray Society by Dr. Richard Dresser, who reported that the high intensity of the ray created by the experimental machine permits a depth dose much greater than has been obtained even with great amounts of radium; and by Professor John Trump, of the Massachusetts Institute of Technology, who described the physical characteristics of the extremely short ray. Operating on the electrostatic principle, by which static electricity is produced by friction, the apparatus is insulated by air under pressure.

A small number of selected patients have been treated with rays created by the new machine. Dr. Dresser stated that the 3,000,000-volt x-rays have essentially the same physical properties as gamma rays of radium. The penetrating effect of these rays of such extremely short wave-length is such that the maximum therapeutic treatment effect occurs not on the patient's skin, but some distance below in the subcutaneous tissue. Thus the new machine may make possible larger doses of radiation directed at deep-seated cancers with proportionately less effect upon the skin and adjacent normal tissue.

These preliminary clinical findings substantiate the observation that as the wave-length of an x-ray beam is decreased, the skin tolerance and depth dose are increased.

LARGER SUGAR CROPS

SCIENTIFIC control has been developed by Dr. Harry Clement, of the Hawaii Agriculture Experiment Station, whereby plantings of sugar cane in any location may be consistently made to yield 100 per cent. of the theoretical yield.

In the beginning of the study a field experiment was set up to show the relative importance of soil and climate. This experiment was unique since the type of climate in the two fields differed radically, although they were only a few miles apart. The temperature of the areas was the same, but one had a low rainfall and high sunlight intensity, while the other was a cloudy region with moderate rainfall. To make sure that the soil for the crops

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was identical, dirt from one was transported to the other. When cane was grown in the two soils under the same climate conditions, the yield was the same. Yet, when cane was grown in these two soils in their respective climates the one yielded 134 tons per acre of good quality cane while the other gave only 65 tons of medium quality.

All attempts to correlate the differences in growth with soil, nitrogen, phosphorus and calcium levels in the plant were without success, but an almost perfect correlation (.999) was obtained when the physical factors of leaf area, crop density and sunlight were considered.

Thus it was evident that yield and quality are dependent, largely, on the atmospheric energy absorbed by the plant. Since the amount of atmospheric energy varies from season to season and from year to year, it is clear that the growth and quality of the plants will also vary. It follows, then, that the index to the fertilizer program lies in the plant as it integrates the influences of the atmosphere.

A system of indices has been established for sugar cane which makes possible the continual adjustment of practices to requirements. The primary index, the sugar content of the sheaths of certain young leaves, reflects the balance existing between the metabolism of the plant and energy available. When this index is normal (about 10 per cent. sugar, dry weight) the plant is growing at the desired rate for the particular climate. If the index rises, the plant is building carbohydrates at a faster rate than it is using them, that is, it could be growing faster than it is. If the index falls below normal, the plant is growing faster than it should and hence quality suffers.

Whatever the primary index shows is the key to adjustments. If the index is abnormal, secondary indices for moisture, nitrogen, etc., are consulted for the cause, and correction in irrigation or fertilizer applications are made accordingly while the crop is still in the fields.

Using this program, much of the guess work in crop management is eliminated. Economically the program pays for itself many times over in saving of fertilizers and of water, not to mention the high yields of good quality crops.

THE EXTERMINATION OF INSECTS

THE farmers' annual blitz season is on. The enemy? Hordes of Oriental fruit moths, potato fleas, boll-weevils, cotton leaf-worms, Japanese beetles, velvetbean caterpillars and hundreds of other varieties of insects. However, the latest communiqué of the Department of Agriculture reports that everything is under control, with only a little mopping up still to be done.

A fresh infiltration of wheat-eating Hessian flies, sweeping east from Kansas to Pennsylvania, are being thwarted by a drastic scorched-earth policy. Since this newest menace is nourished in its larval stage by the juice of tender young wheat stalks, it can be combatted by the ruthless destruction of "volunteer" or random between-crop growths of wheat which offer breeding ground to the thirsty Hessian maggots. It is also circumvented by "delayed seeding," since a touch of frost is harmless to wheat but slows down flies.

Our important wartime crops of peanuts and soybeans

have been menaced by white-fringed beetles, leaf-hoppers and velvetbean caterpillars, which can be dusted with cryolite from low-flying airplanes. The white-fringed beetle is a new importation from South America, which research experts in Agriculture's Bureau of Entomology and Plant Quarantine believe is now under control.

The beetle called grape colapsis, fond of soybean in its grub stage, can be foiled by rotation of crops. The cotton season has presented, in addition to the annual boll-weevil menace, an urgent epidemic of cotton leaf-worm, or Alabama ardisillacea, which migrates annually from the tropics. Thanks to calcium arsenate, dusted from airplanes, this is now under control, except for the northern edge of the cotton belts. Entomologists are now working on a new cotton pest—the pink boll worm. Except for a few enemies such as the gipsy-moth, crickets and grasshoppers, government entomologists content themselves with research, information service and regulation of harbor and inter-state plant quarantine, letting the farmers carry on the actual warfare.

The innumerable pests which eat stored grain, wool and tobacco in warehouses are an ever-present problem, requiring a vigilant policy of fumigation and "dusting the air" with arsenate compounds.

Although nicotine bentonite is sometimes used in spraying fruit, the most common defense weapon is arsenic, now being absorbed by the war against human enemies. Although no shortage of arsenic has been felt so far, farmers and government experts are not too hopeful about next year's supply.

Fruit pests alone number between 250 and 300 varieties, while another myriad of species attack potatoes, vegetables and all forms of truck crops. Booby traps composed of poison bait are used for some varieties: spraying, dusting, rotation of crops for others. The corn earworm can sometimes be taken in by breeding longer husks on corn. Those worms you'll be eating with your apples this fall are most apt to be youthful codling moths or Oriental fruit moths.

ITEMS

THE unusual dampness which in most agricultural areas had delayed the maturing of crops, and aroused fears of frost damage should frost come early this year, have given way to good growing weather—warm and with plenty of sunshine. According to reports issued by the U. S. Weather Bureau, in some places corn grew twice as fast as normal for this time of the year. On the whole, in fact, growing conditions have been unusually favorable throughout the whole season, and crop yields 12 per cent. higher than in any past year are predicted. If the fall weather continues good, the final yields may exceed present forecasts. In any case there is a big harvesting job ahead.

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To insure production of the highest quality of dehydrated foods for the armed forces of the United Nations, the U. S. Department of Agriculture announces the opening at Albany, N. Y., within the next few weeks of the first school to train commercial manufacturers in improved methods of processing developed in government research laboratories. Because of the urgent need to conserve shipping space and to prepare foods in a form which will keep indefinitely in any climate, the training program will be expanded sometime this fall to include a school at Rochester, N. Y. The training program is being jointly conducted by the Agricultural Research Administration and the Agricultural Marketing Administration, which is the Lend-Lease purchasing agency. Subjects included in the courses will be selection of vegetable varieties, storage problems, processing, packaging and laboratory control, to provide maximum quality for this fuel for the fighting men of the United Nations. Recent improvements in dehydration processes make possible the shipment of dry vegetables, milk, meat and other food-

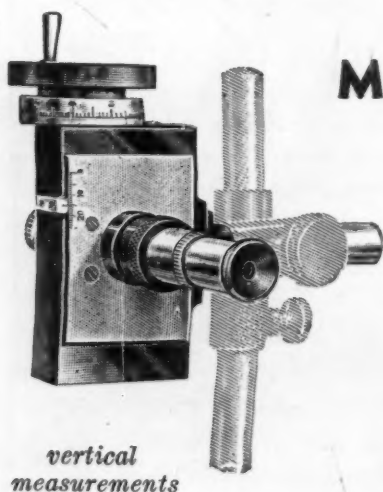
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THE death rate from tuberculosis in the United States continues to decline, despite an upswing of cases in European countries, according to the report of the National Tuberculosis Association. Last year 44 persons died of tuberculosis for every 100,000 population, compared with 46 the previous year. This totals 59,173 persons dead and 105,714 new cases reported. Despite continued improvement in the death toll, there is slowing up of the downward trend of cases in this country. Dr. Kendall Emerson, managing director of the association, points out that under wartime conditions tuberculosis may show an increase here, just as it already has in warring countries of Europe. Various theories have been offered to explain the increase abroad. Among them are decreased resistance, due to longer hours of work, strain, anxiety, inadequate diet, broken rest, overcrowded homes and shortage of medical and nursing personnel. There is every reason to believe that, as the war goes on, these factors will operate in this country unless voluntary and public health authorities are able to use all their resources. Every effort is being made to keep tuberculosis out of the armed forces. Army doctors are fully equipped for x-raying and are authorized to reject all those who may have or who have had the disease.

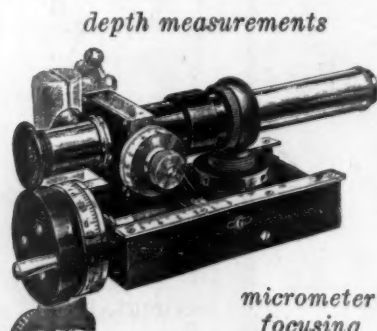
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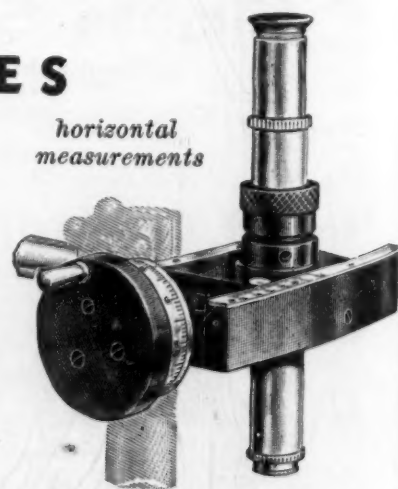
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SCIENCE NEWS

Science Service, Washington, D. C.

NOVAE

A TEMPORARY star or nova which suddenly flares up in the heavens without warning and then gradually fades, is not quite the cataclysmal event that some theoretical physicists have supposed. This view was expressed by Dr. Dean B. McLaughlin, professor of astronomy at the University of Michigan and secretary of the American Astronomical Society, speaking before a recent meeting of the Rittenhouse Astronomical Society at the Franklin Institute.

The outburst is a surface explosion, Dr. McLaughlin believes, of tremendous proportions to be sure, involving as it does the entire surface, but not necessarily fatal. After "blowing off steam," the star returns to approximately its former state. Its temporary excursion into notoriety produces little change in its normally humdrum life.

Dr. McLaughlin's view is based on a personal examination of all spectra of "novae," or new stars gathered at the University of Michigan Observatory and at the other leading observatories of the United States. It is a good idea, he said, for "one set of eyes, with one set of prejudices" to examine all the observational material.

New stars at maximum light, he explained, are about 50,000 times as bright as the sun, though they are so far distant that they appear like ordinary stars. Before outburst they are about the same real brightness as the sun but are smaller, denser and hotter—a type known as subdwarfs. Increase of light from minimum to maximum takes only a few days, but the decline takes several years. The flare-up must be due to an explosion whose cause is not known. The surface layers expand as a cloud of gas around the star at a speed of hundreds of miles per second. After some months the expelled clouds of gas become visible as a faint nebula around the star. At the end of the decline the star is apparently not changed from its previous condition, and it must be concluded that all the disturbance is superficial.

Altogether about 90 novae have been recorded in our milky way system, and over 100 have been found in the neighboring spiral nebula Andromeda.

ENERGY OF THE SUN

MAN is harnessing the sun to supply power for his home, factories and vehicles. Long a dream, present research indicates that the future world may be powered by energy snatched from a sunbeam. But practical application awaits results of the long-range research program now being conducted.

Many such glimpses of happenings in science are presented in the annual report of the Smithsonian Institution, which has just been issued.

Utilization of scientific advances in post-war reconstruction, however, will require sources of power not dependent on dwindling resources. Energy equal to 21,000,000,000 tons of coal which the sun showers on the

surface of our globe every hour, offers fascinating possibilities.

There is one major obstacle to harnessing this power: economics. Power produced, the report indicates, depends directly on the area over which solar energy is gathered. This would need to be large and the cost consequently high. Solution of this problem has been a foremost objective of Smithsonian Institution researches.

Dr. Charles G. Abbot, secretary of the institution, has built highly efficient solar engines which have come close to economic practicability compared with other power-producing systems.

Various possibilities of solar energy are outlined by Dr. H. C. Hottel, of the Massachusetts Institute of Technology, where experiments are also being conducted. Their program calls for exploration of all the possibilities of economic conversion of solar energy into forms useful in industry.

One method would be direct conversion of the sun's rays into electricity. This would be based on the principle of the thermocouple. That is, when two wires of two different elements are joined and the junction is heated, a small part of the heat is converted into electrical energy. Efficiency here depends on the properties of the two materials used. Intensive study is now in progress to learn which metallic compound give the best results.

Another apparatus is operated by photoelectricity—the same principle which operates the exposure meter used by photographers. Here the light strikes a specially prepared metal plate which also results in conversion to electrical energy.

Or perhaps, it is suggested, we can duplicate nature's own method of storing solar energy. Through chlorophyll, the green stuff in leaves, sunlight is stored in growing things. Perhaps millions of years later it is released by the burning of coal or oil. It is hoped that through a thorough understanding of nature's process, we may be able to make synthetic fuels out of easily available chemicals in a few minutes.

Atomic power, discussed by Dr. Ernest O. Lawrence, of the University of California, is also much in the news. Recent progress must be kept secret at this time. But up to about a year ago the status was about that of aviation fifty years ago. That is, the basic principles are known, but practical application awaits the development of a new instrument or technique.

THE CORROSION OF IRON PIPES

BACTERIA have been found responsible for corrosion of iron pipes carrying deep well waters in the Miami Valley, Ohio. These waters contained very little oxygen and practically no other corrosive substances that could be detected by the usual chemical test. Similar trouble with "red water" at Middletown, Ohio, has been cleared up with chlorine treatment which killed the bacteria.

TEXTS FOR WAR TRAINING COURSES IN METEOROLOGY AND NAVIGATION

Elementary Meteorology

By VERNOR C. FINCH and GLENN T. TREWARTHA, University of Wisconsin, M. H. SHEARER, Westport High School, Kansas City, Mo., and F. L. CLAUDLE, University of Wisconsin, Extension Division. 290 pages, 6 x 9. \$1.76

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Workbook in Meteorology

By A. F. SPILHAUS and JAMES E. MILLER, New York University. In press—ready in October

A collection of project type exercises designed to be used in conjunction with any textbook on elementary meteorology. Suitable to be worked out in laboratory or as home assignments, the exercises are grouped to correspond to the chief divisions of meteorology: climatology, instruments and observations, physical and mathematical considerations, and weather analysis.

Meteorology and Air Navigation

By BERT A. SHIELDS, Lt. Comdr., U. S. Naval Reserve. 288 pages, 6 x 9. \$2.25

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Introduction to Meteorology

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By P. V. H. WEEMS, Lt. Comdr., U. S. Navy (Retired). Second edition. 574 pages, 6 x 9. \$5.00

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By HORACE R. BYERS, University of Chicago. 279 pages, 6 x 9. \$3.50

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Dynamic Meteorology

By BERNHARD HAURWITZ, Massachusetts Institute of Technology. 365 pages, 6 x 9. \$4.00

This lucid treatment of the laws of thermodynamics that operate in the atmosphere constitutes a fairly elementary discussion of the fundamental principles and theories underlying the modern methods of air-mass analysis, isentropic, and frontal analysis. Mathematical technique has been kept as simple as possible.

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The investigation which led to this discovery was carried out by Dr. Arba H. Thomas, chief research chemist of the American Rolling Mill Co., of Middletown.

The organism chiefly responsible, Dr. Thomas found, was *cocco bacillus*, an organism of the anaerobic type. This type requires no oxygen for its life processes. In fact oxygen is poison to it. This type reduces sulphates in the water and liberates hydrogen sulphide which attacks the iron producing the black iron sulphide. This kind of corrosion is therefore very different from that produced by electro-chemical action which results in the red oxide of iron or rust.

Other organisms, the so-called "iron-consuming" bacteria, were also found. These, the *crenotherix*, *spirophyllum* and *leptothrix*, do not actually devour metallic iron, but they do consume dissolved ferrous salts, converting them to the insoluble red ferric hydroxide or a similar substance, producing "red water."

By introducing oxygen into the water, it was found that the rate of corrosion decreased as the quantity of oxygen increased, just the opposite to what would have occurred if oxygen had been the cause. These bacteria, Dr. Thomas said, have long been known to biologists, but their connection with corrosion was only recently suspected. They are not disease producing.

The remedy is to chlorinate the water, or where it is to be used for drinking purposes and the chlorine taste would be objectionable, the chlorine-ammonia or chloramine treatment can be used. This not only kills the bacteria, but removes any deposits that have already been formed on the metal. Ordinary lime-soda softening treatment will kill the less resistant types of bacteria, but not the hardier ones. Also a good coating of a coal-tar base enamel will protect the metal.

OIL FOR THE ALASKA HIGHWAY

AVIATION gasoline and diesel engine oil will soon be flowing through a new pipeline toward the Alaska highway from oil wells and the world's most northern refinery at Fort Norman on the Mackenzie River in Canada 125 miles south of the Arctic Circle. Vast untapped tar sands in northern Alberta are being mined for oil, gasoline, asphalt and coke.

The wells at Fort Norman have been in existence since 1921. They were little used, however, in fact were capped until 1930, when discovery of radium on Great Bear Lake shores brought aerial prospectors in vast numbers. Shortly after the outbreak of war a new refinery was built at Fort Norman producing aviation gasoline and diesel engine oil. This plant, according to Munitions and Supply Minister C. D. Howe, has now been expanded, and will probably be in use for a longer period than just during the summer, as it has since installation.

"An intensive study of the tar sands is under way at present time," stated Minister Howe, in Parliament. "To-day we think of that area as a source of immediate oil production, provided the problems connected with its development can be solved rapidly and with some degree of certainty. Arrangements have been made to develop further the wells on the lower Mackenzie River at Fort

Norman. Additional wells are being drilled, the refinery capacity is being increased, and a short pipeline is being installed to bring the oil across to the location of the Alaska highway."

From the sands along the Athabasca River in northern Alberta, Indians have since time immemorial used pitch to caulk their canoes. The first white men to come into the area in 1788 found the oil sands to stretch for miles, and in some places found oil bubbling to the surface. Since the settlement of Alberta many attempts have been made to obtain oil from these oil-rich sands. Last year the first successful commercial extraction plant began operations to obtain lubricating oil and gasoline from the tar sands.

The oil sands along the Athabasca River are considered by oil authorities to be one of the largest oil reservoirs in the world. According to the geological estimates of the Canadian Government, the oil sands contain at least a hundred billion barrels of oil. But it will be a big job to get it out.

Because of transportation difficulties and because no suitable extraction system had been devised, the oil sands remained unworked. These oil-saturated sands range in thickness from a few feet to 225 feet, and in oil content up to 25 per cent. by weight. They cover an area estimated at from 10,000 to 50,000 square miles. A large part of the area is overlain with shale and sandstone up to a maximum depth of 1,800 feet, and underground methods of mining are not considered workable. The oil will not flow into wells fast enough to be pumped commercially. But erosion on the Athabasca River and its tributaries has left benches that can be mined by open pit methods.

The bituminous sands have produced a high quality of asphalt which has been used for paving fairly extensively in the past, and it is expected to be used for this purpose also on the Canada-Alaska Highway now being built. They stretch for miles on each side of the river, covering roughly an area 115 miles north and south, and 55 miles east and west. The sands lie about 600 miles north of the international boundary in an area which can be developed the year round.

The extracting plant which went into operation last year on a small scale took 11 years of research by American engineers to develop. The sands go through a separation process, then to a refinery where the crude oil is turned into gasoline, diesel fuels, fuel oils, asphalt and coke. It is thought that synthetic rubber may also be developed from these bituminous sands after they pass through the separation process.—JAMES MONTAGNES.

ITEMS

A CONSIDERABLE sector of the vast plastics industry is founded on coal, Dr. R. L. Wakeman, of the Mellon Institute, and Dr. B. H. Weil, of the Gulf Research and Development Company pointed out. Some of the best known and most useful plastics are formed in part of phenol, and phenol is a coal product. The other half is often formaldehyde, made from water gas, which in turn comes from coal or coke. These plastics play their part

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RESEARCH pays in hard, cold cash, Eugene Ayres of the Gulf Research and Development Company told the meeting of the American Chemical Society recently. He explained a numerical yardstick which he has developed, which gives an estimate of the differences in costs between industrial processes put into operation without waiting for preliminary experimentation and those that are given the benefit of research in laboratory and pilot plant, together with proper patent procedures, before they are strated. If a given industrial problem is carried through all three steps, or research, patent procedures and pilot plant experiments, the total cost of "make-ready" is considerably less than half that involved in rushing into full production without the preliminary steps. How necessary the pilot-plant stage is also shows up in the table. With laboratory research and patent procedure, but omitting pilot plant, the costs were substantially greater than those of complete preparation, though still substantially less than those of no preparation at all. Mr. Ayres cited the case of a company that found it necessary to go into the manufacture of a new chemical in a hurry: "There were no large-scale precedents for this operation, but two

good process ideas were offered by the Research Department. Because of the emergency, it was decided to commercialize one idea without any research, while the second idea was carried in orderly fashion through laboratory and pilot plant. Despite the delay occasioned by months of research, the second idea resulted in a smoothly operating plant before the first and at much lower development cost. The first idea was then sent back to the Research Laboratory and a year later superseded the second."—FRANK THONE.

Not just his brain, but a pilot's teeth as well, may "black out" when he pulls out of a power dive. The suggestion is made by Capt. Herbert J. Lipson, M.C., U.S.A., and Dr. S. G. Weiss, Muskogee, Oklahoma, dentist, in a report in the *Journal* of the American Dental Association. The centrifugal force which pulls the blood away from the pilot's brain, causing the familiar "black out" symptoms, would also pull the blood out of the pulp of his teeth. The absence of any recoil mechanism in the "hard, unyielding wall of dentin" surrounding the tooth pulp makes it unlikely that recovery from a "black out" in the tooth would be "so efficient or so nearly complete as in the brain." Permanent damage or death of the tooth might result. Extreme cold at high altitudes and the "bends" to which aviators as well as divers are subject might also cause injury of the tooth pulp.

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SCIENCE NEWS

*Science Service, Washington, D. C.*STRANGE RESULT OF AN ATTEMPT TO
PRODUCE NICKEL POWDER
ELECTRICALLY

IN attempting to produce nickel powder by rapidly electroplating the metal on a copper sheet, Dr. Oliver P. Watts, professor of electrochemistry at the University of Wisconsin, ran upon a strange phenomenon which he reported to the Detroit meeting of the Electrochemical Society.

A coating of nickel appeared on the back of the copper but none on the front. This, he said, was contrary to all recorded experience with plating solutions. Furthermore, no nickel powder was produced.

Dr. Watts had tried to utilize that "bugbear" of the plater, the "burned" deposit, by passing a very large current of electricity through a dilute solution of nickel sulphate. This should have done the trick, because too heavy a current produces a crumbly deposit which frequently drops off. To increase the conductivity of the solution and thereby increase the current, Dr. Watts had added a large amount of sodium sulphate to the solution and also heated it. Such "conducting salts" are frequently used. To his surprise he got only a film of alkali on the front of the plate, but a good adhering coat of nickel on the back. Measurements showed that three quarters of the current had been employed in depositing the alkali and only a quarter in depositing the nickel. The latter part of the current had to pass around the edges of the plate to reach the back. Usually in electroplating the front of an object is more heavily plated than the back. Other metals and other solutions were tried and it was found that the same thing could be done with cobalt and iron, but not as yet with tin, zinc or copper.

As a possible commercial use of this curious phenomenon, Dr. Watts suggests that the solution might be so regulated as to plate front and back equally, but so far he has been unable to get any happy medium between a thicker coat on the front and none at all there.

REAPPEARANCE OF SCHWASSMANN-
WACHMANN COMET

A NEW comet announced by L. Oterma at the Observatory of the University of Turku, Finland, reported to Harvard Observatory through Lundmark, Sweden, is none other than the famous Schwassmann-Wachmann Comet No. 1 which has been under constant observation by American astronomers for the past 15 years.

This is not the first time that this comet has been mistaken for a new one. On August 29, 1941, Dr. G. Neujmin, of the Simeis Observatory in the Crimea, observed it and announced a new comet. But only a few weeks before Professor G. Van Biesbroeck had observed it at the Yerkes Observatory. This time again it was observed only shortly before being mistaken for new, namely, on September 6 at the McDonald Observatory. Dr. Van Biesbroeck has recently calculated its positions for the last four months of this year.

This comet is one of the most remarkable known. Its orbit is nearly circular, lying wholly between the orbits of Jupiter and Saturn about 500,000,000 miles from the sun—five times the distance of the earth from the sun. From time to time, the comet, for some unknown reason, increases in brightness, although never becoming visible to the unaided eye. It was during one of these flare-ups that it was discovered in 1927 by the two German astronomers whose name it bears, and it was at a flare-up on each occasion that it was mistaken for a new one.

Because of its nearly circular orbit, the comet is seldom beyond reach of our powerful telescopes and our photographic plates. It descends at times to the 18th magnitude, at other times brightens, as at present, to the 12th magnitude, 250 times as bright. It shows at present a sharp nucleus surrounded by a nebulous envelope. At other times it appears like a faint star.

AUTUMN COLORS

THE bright leaf colors that everybody admires in the autumn are actually there all summer. They are not usually visible until shorter, cooler days come because they are masked by the stronger green of the more abundant chlorophyll pigment, which crowds them into the background. One of the autumnal changes in the plant is the chemical breakdown of the chlorophyll, which becomes colorless, thus permitting the reds and oranges to shine forth.

Leaf colors are of two distinct classes. The purples and purple-reds are due to a soluble type of pigment that is present in the plant sap. It is the same stuff that makes beets red and some kinds of cabbage purple. The yellows and bright reds are due to pigments of the carotin type, which exist in solid little lumps embedded in the living protoplasm of the cells. They are not as easily soluble as the purple pigment in the sap, and won't come out if you soak the leaves in hot water.

Combinations of the purples, purple-reds, oranges and true reds make all the varied, mottled colors we find in autumn leaves—and in the skins of autumn fruits as well. Leaves of a clear yellow, such as you sometimes find on hard maples, have no purple pigment in the sap. Leaves like those of sumac and sweetgum, of a strong, deep wine-red, are colored by a combination of purple sap-pigment and red carotin in the cells. The changes that may be rung on this color-chime are literally endless.

Even more remarkable than the wonder of leaf coloring, though much less conspicuous, is the provision made by the leaves for their falling off. They do not just snap off and drop, as a dead twig might. That would leave the tree covered with thousands of tiny, open wounds through which bacteria and fungus spores might enter, to cause disease and decay. At the point where the leaf-stem is later to detach itself from the twig, a double layer of specialized, corky cells forms, finally cutting off the sap flow to and from the leaf. When it is complete, the union between the two layers becomes dried out and

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Complete Patent Index.

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1942. 708 pp. 180 ill. \$11.00

INTERSCIENCE PUBLISHERS, INC.

215 Fourth Avenue, New York, New York

weak, and finally a little puff of wind finishes the job, letting the dead leaf drift down to earth.

Botanists have given this double layer a special name, "absciss layer." But that is only Latin for cut-off layer, and that is exactly what its function is. The tree or shrub is thus able to bandage its wounds before they actually exist. That is a trick that surgeons and first-aiders would give a good deal to be able to do for humans.—FRANK THONE.

IMMUNE SERUM IN THE TREATMENT OF INFLUENZA

If an influenza epidemic strikes this winter, the use of immune serum from the blood of the first patients attacked "should be considered" for treatment and prevention and for further studies of influenza prevention, according to a report made by Dr. Joseph Stokes, Jr., of the School of Medicine of the University of Pennsylvania, at the meeting of the Medical Society of the District of Columbia.

Dr. Stokes's cautiously worded advice to his fellow physicians was based on extensive experiments with mice in which relatively small amounts of immune serum protected mice against influenza virus when the protective serum was inhaled by mice. Somewhat larger amounts of the immune serum were required when the serum was injected. In treatment of the mice, the immune serum had to be given within six hours after infection with influenza virus.

Immune serum, from the blood of persons who have just had influenza, contains substances called antibodies which are defensive forces of the body for fighting off the virus. Instead of borrowing these defensive forces from some one who has already had the disease, it is possible to build them up in a person's own blood by vaccination with influenza virus. Dr. Stokes recently reported that such a vaccine protected 43 out of 44 boys who were directly exposed to influenza virus in an experimental study.

The third method of protection against influenza epidemics described by Dr. Stokes consists in sterilizing the air of hospital wards, school rooms, barracks or similar places where large numbers of people congregate. This sterilization may be done by ultraviolet rays or by spraying propylene glycol vapor into the room. The latter seemed to be somewhat more effective than the ultraviolet rays.

Neither of these air sterilization methods, however, can be entirely relied on to stop an influenza pandemic such as swept the world in 1918. The reason, Dr. Stokes explained, is that in pandemics, the travel of the virus through the air may not be the chief manner in which the disease is spread. In pandemics, the disease breaks out suddenly in many widely separated places at the same time. Virus spread through the air is more a factor in epidemics such as those of recent years which traveled across this country in a few weeks.—JANE STAFFORD.

ITEMS

A NEW electronic instrument is being used in flight tests of airplanes which records temperature and pressure changes at the rate of 144 readings every three or four

minutes. Developed by the Brown Instrument Company, Philadelphia, this flight recorder replaces three or more men who needed half a minute to write down each reading manually. It was first used on the world's largest plane, the Douglas B19; the recorder automatically printed on paper, during the test flight, the temperatures of all 72 cylinders of the four motors, changing temperatures of the carburetor, exhaust, and of the oil in the fuel lines, and the pressures on wing struts, bulkheads and tail surfaces. In the case of single-seater pursuit ships, the recorder made records that otherwise could not be obtained because test engineers in addition to the pilot could not be carried aloft.

THICK and extra hard coatings of nickel can be formed by adding ammonium salts to the plating bath, and properly proportioning the other ingredients, Dr. W. A. Wesley, assistant director, and E. J. Roehl, research chemist, of the Research Laboratory of the International Nickel Company of Bayonne, N. J., reported to the Detroit meeting of the Electrochemical Society. Many new problems arising in defense activities, the investigators said, involve surfacing of parts to resist wear and corrosion, and the salvaging of worn and mismachined parts, by the electrodeposition of heavy metal layers. The coatings must be hard, have strength, ductility, machinability, adhere strongly, and have a heat expansion close to that of steel. Furthermore, the deposits must not be in layers such as the old "hard baths" gave, but must be homogeneous.

ASTRINGENTS, chemical substances such as are used in so-called "skin tightenings," may enhance the effect of germicides and disinfectants, it was reported before the Denver meeting of the American Pharmaceutical Association. Much used but long in ill repute as antiseptics, the astringents now take their place as an adjunct to other antiseptics. The double action of the two is often desired by physicians but the boost given to germ-killing power of antiseptics by the astringents had not been fully realized. Research evidence presented by Joseph B. Sprowls and Charles F. Poe, of Boulder, Colo., indicates that such chemicals as tannic acid, widely used for burns, has a beneficial effect on the action of several common antiseptics. Development of a single-dose emergency hypodermic unit at the request of the War Department was also reported to the pharmacists by J. D. Hulsman and F. W. Nitardy, of Brooklyn.

How much water there is in a jelly-fish is the subject of discussion in England even during war time. Dr. A. G. Lowndes, at the Plymouth Biological Laboratory, has determined that jelly-fish in the ocean near Plymouth are composed of about 96 per cent. water, 3 per cent. salts and a trace of fat. The amount of protein, 0.67 per cent., indicates that the animal has only about 4 per cent. protoplasm, the stuff of life. Text-books have long told that jelly-fish contain 99.8 per cent. water, but while they are very liquid, their water content is not as high as that. Most marine animals contain about 80 per cent. water and 15 per cent. protein.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE AMOUNT OF OIL TAKEN UP
BY SAND

How much oil can an oil sand take up? This problem is of importance not only to the petroleum geologist but to the physicist, chemist and botanist.

The answer is given by Dr. Edward Kasner, professor of mathematics at Columbia University, in a report to the American Mathematical Society. If the grains are perfect spheres, all equal, he says, then for the closest packing 25.955 per cent. of the whole space will be vacant, and can be filled with oil or other liquid; while 74.055 per cent. will be occupied by the sand. This result can be tested experimentally by filling a box with sand and then seeing how much water can be poured in.

The proportions of occupied and unoccupied space will be the same whether the spheres are large or small, provided they are all equal. But if they are unequal, and suitably arranged, then a larger portion of the space can be occupied by the sand, and consequently less oil or water taken up.

This may easily be visualized if we pack a box with oranges. Between the oranges we might insert nuts, between these and the oranges we might get in some peas, and in the spaces still vacant fine shot, and so on until we get down to the finest powders. Thus we would fill up more and more of the space. Mathematically this could go on forever—an infinite series of spheres—of diminishing size. Practically we have to stop with the smallest particle that can be handled. Experiments with mixed sands have in fact succeeded in reducing the vacant space to a few per cent.

It is obvious that spheres, however packed, will have small gaps and therefore space can never be filled 100 per cent. But by a suitable arrangement 99 per cent. can be filled or 99.999 per cent. or as near 100 per cent. as desired. The work is purely mathematical since we are dealing with ideal perfect spheres. In a similar way the plane can be covered with circles (coins or discs of various sizes).

The full mathematics, Dr. Kasner said, will shortly be published in a technical journal.

METALS

How minute cracks, porosity and surface blow holes in metals, invisible to the eye and to x-rays, can be beautifully shown up by use of a fluorescent dye and ultraviolet light was exhibited at the Cleveland meeting of the American Society for Metals by Taber de Forest, research engineer of the Manalux Corporation of Chicago.

The method is far more sensitive, Mr. de Forest said, than the old kerosene and whitewash method that has been used for this purpose. The liquid which carries the dye penetrates the minutest cracks by capillary attraction, and is washed off from the rest of the surface by plain water. It is true that either of these methods reveals only cracks that reach the surface, but deep-seated defects are often connected with the surface by a network of

capillary cracks. Fatigue cracks, it is known, originate on the surface, and shrinkage cracks of castings often appear there. Besides, a small crack is often the starting point of a later failure. These small cracks are not revealed by x-rays because a relatively spacious void is necessary to show up on an x-ray picture.

A simpler and faster method for observing the rate at which one solid metal diffuses into another, an important matter in many practical fields, was described at the same meeting by Howard S. Coleman and Henry L. Yeagley, of the Pennsylvania State College. An extremely thin film of the one metal was condensed on the surface of a microscope slide, and a similar film of the other metal deposited on top of it. Such extremely thin films are semi-transparent. The reflecting power of the contact surface between the two metals was measured and recorded continuously by a photoelectric method, using a powerful automobile headlight as a source of light. As the one metal diffused into the other, the reflecting power of the surface diminished, and was shown by a drooping curve. Under some circumstances a test can be made in as little as five minutes.

NEW STANDARDS ADOPTED FOR
TOTAQUINE

DR. E. FULLERTON COOK, chairman of the committee of revision of the U. S. Pharmacopoeia, reports that new standards will soon be officially announced for the anti-malarial, totaquine.

The medicine is a mixture of substances, including quinine, obtained from "Jesuit's Bark." This mixture has the same action against malaria as quinine, but has been little used in this country. Lowering the quinine content to 7 per cent., results in fuller use of South America barks which analyses show average only 1 per cent. quinine. This does not include about a fourth of the bark samples which contained practically no quinine. They contain the other anti-malarial substances, however, which it is believed can be just as effectively used as quinine. The former standard required 10 per cent. quinine or more. Now a ceiling of 12 per cent. will also be included. This presumably was adopted to insure uniform results in treatment and to prevent conflicting therapeutic claims and price differences. Authorities feel that these would be unjustified merely on the basis of one preparation containing more quinine than another.

Another requirement that at least a fourth of the product be cinchonidine and cinchonine will be completely dropped. The lower limit of 70 per cent. total crystallizable alkaloids will have a ceiling of 80 per cent. in the new monograph.

The new standards will be maintained, Dr. Cook explains, for at least the "duration" while the maximum use of anti-malarial supplies is necessary due to exposure of our troops to the fever and the cutting off of our usual imports from the Far East.

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In this book a nationally known authority provides a textbook especially suited for use in the beginning course in animal husbandry in agricultural colleges. The approach is unusual, the coverage of subject matter is exceptionally broad, and the objectives differ from those of most other texts in the field.

Methods of Plant Breeding

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The general purpose of this significant book is to outline and illustrate the methods and principles involved in scientific plant breeding. Various methods of breeding are discussed, examples are given and all the steps are covered in detail. Breeding for disease and insect resistance is thoroughly treated. The genetic basis of plant breeding is emphasized strongly.

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The authors of this book have assembled in brief but accurate form the basic information underlying the various empirical practices pertaining to the many crops and phases of ornamental gardening. The text brings together in one volume a unique combination of horticultural topics of scientific and practical nature as well as design and horticultural taxonomy.

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By CHESTER L. ROADHOUSE and JAMES L. HENDERSON, University of California. *McGraw-Hill Publications in the Agricultural Sciences*. 624 pages, 6 x 9. \$5.00

Covering the entire field, this book gives the student an understanding of the technical and economic phases of the market-milk industry. The authors describe approved procedures in the grading, pasteurizing and cooling of milk, the preparation of cultured buttermilk, table and whipping creams, homogenized, soft curd and vitamin D milk, etc.

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The consensus of opinion expressed by experts on tropical diseases at a recent conference called by the National Research Council in Washington is that totaquine is equal to quinine in efficiency in treating malaria.

HOUSING AFTER THE WAR

ABOUT a million new homes per year could be used by Americans during the decade following the war, if they are built in the right places at the right prices, it is estimated in a report issued by the National Resources Planning Board. Besides this there will still be a need for a large volume of repair during the same period.

This potential boom in home building has developed because only three new dwellings have been built for every five additional families that have been formed during the last decade, and because of the drastic curtailment of housebuilding during the war years.

War time housing will take care of only acute needs, according to Miles L. Colean, author of the pamphlet released by the Board. It is also likely, he says, that many war dwellings will not be in the areas where they will be needed after the war. Meanwhile, out-dated and worn-out houses throughout the country continue to deteriorate.

If we had better means for providing attractive, low-priced houses, according to the report, a huge demand would exist for the replacement of these deteriorated and outmoded dwellings amounting perhaps to as much as a fifth of the total stock of about 37,000,000 dwellings, or somewhat over 7,000,000 units ripe for replacement. About 2,000,000 of these are needed on farms alone.

Continued research in materials and techniques is recommended as one of the long range methods of solving this housing problem. This statement recalls plans by some authorities for standard models of houses. They believe this would be a big help, just as standard auto models have made new cars available to most families in the past. These houses would roll off assembly lines in mass production to be assembled in sections with a minimum of expensive "custom tailoring" at the building site. New building materials are also likely. Some foresee the use of plastic-and-plywood walls with a stainless steel roof. Such a house would be strong yet so light that two men could lift the whole wall of a room as they put it up.

Application of scientific research should bring prices down to where the new homes could be constructed all over the country by the hundred thousand. Price has been the main drawback in the past, although it is being steadily reduced. In 1925, dwellings were built for around \$4,800 per unit, while in 1940 the average price was down to \$3,700.

Other steps outlined in the report as possible aids to accelerating the postwar building program included removal of legal restraints within the house-building industry; preparation of model building codes by the government based on ample engineering service and providing localities with facilities for consultation and testing; and improvement of present government aids for providing adequate housing for Americans.

ITEMS

A CALL has been issued from the Society of American Bacteriologists for motion pictures to aid in wartime teaching. With accelerated courses and shortage of teachers at many colleges, it is believed motion pictures on bacteria, rickettsiae, viruses, fungi and animal parasites would be helpful in stopping the gap. The society has appointed a committee, under the chairmanship of Dr. Harry E. Morton, of the School of Medicine of the University of Pennsylvania, to collect information on the usefulness and availability of such films.

THE acoustic movements of the human ear drum have been seen and photographed for the first time. Moving pictures showing these movements of normal ears and also of ears of patients suffering from deafness were shown by Dr. H. G. Kobrak, of Gary, Ind., and Dr. J. R. Lindsay and Dr. H. B. Perlman, of Chicago, at the Chicago meeting of the American Academy of Ophthalmology and Otolaryngology. Fresh specimens from human cadavers were used. The various parts of the sound conduction apparatus were exposed and the vibrations during the conduction of sound were photographed. On stroboscopic illumination acoustic vibrations of the ear are seen as distinct and slow movements.

A NEW discovery, which may lead to more complete knowledge of our protohistoric North American ancestors and help bridge the 10,000-year gap in archeological knowledge, has been made by Dr. Frank H. H. Roberts, Jr., of the Smithsonian Institution. A bison wallow, two or three thousand years old, which Dr. Roberts excavated in eastern Wyoming, uncovered a number of spear points known as "Yuma points" and formerly thought to date back to the oldest known inhabitant of North America, the Folsom man who lived at the end of the last Ice Age, 10,000 to 20,000 years ago. This new discovery, however, places the Yuma points at a much later date, somewhere between Folsom and modern.

OWNERS of oil burners who are able to secure a wood supply will be able to substitute wood for oil, according to an announcement made by William L. Slate, director of the Connecticut Agricultural Experiment Station. As a result of research in cooperation with Yale University and the University of New Hampshire, the station has developed a wood-burning unit which can be built out of firebrick by any good mechanic and connected with an oil heater of the convertible type. Wood in the fuel magazine is carried by gravity to the combustion zone, where it is distilled with gas. After introducing secondary air, the gas passes into the furnace and burns at high temperature. This emergency unit holds a tenth of a cord of wood, which is sufficient to heat a ten-room house for 12 hours in cold weather without further attention. The only metal part required is the cast-iron door and frame, for which arrangements are now being made. A special bulletin giving the details of construction and operation may be secured from the station or from the Connecticut Forest and Park Association, P. O. Box 1577, New Haven, Conn.

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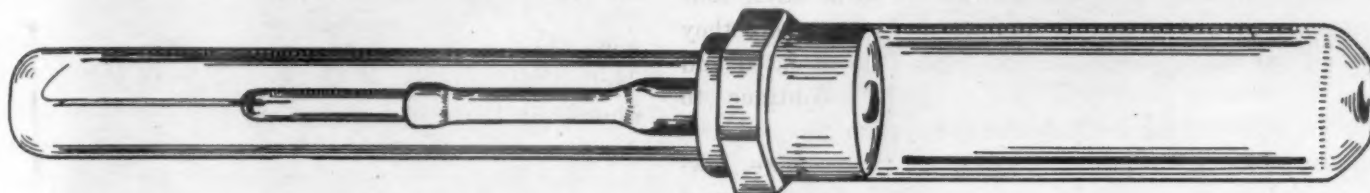
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SCIENCE NEWS

Science Service, Washington, D. C.

THE LAW OF GRAVITATION

IN this two hundred and ninety-ninth year since the birth of Sir Isaac Newton, which occurred Christmas day, 1642, according to the Old Style Calendar then in use in England, his law of gravitation is still on trial, but is winning, according to a report made by Dr. Fritz Zwicky, professor of theoretical physics at the California Institute of Technology, to the Astronomical Society of the Pacific.

The question is not whether the precise form of the law is Newton's or Einstein's, but the extent of its application whatever its form. Newton believed his law to be universal. "Every particle of matter in the universe attracts every other particle . . ." was Newton's formulation.

But it was a small universe in Newton's time. The extension of the force of gravity to the moon, and its action in producing the tides, were demonstrated by Newton himself. Its application to the planets and their satellites was readily verified in his time. Its application to comets was firmly established by the return of Halley's comet as predicted, seventy-seven years after the calculations were made.

But all this concerns only our immediate solar system, a small speck in a vast universe of stars. Do the stars also obey this law? To answer this question took more time. Double stars revolve about each other, but often require many years to complete a revolution, and are so far distant that the changes of position as seen in the telescope are of microscopic dimensions. It was not until 1830, more than a century and a half after the publication of Newton's law, that Savary was able to show that the motions of these bodies are elliptical and the law of gravitation therefore applies.

But these stars belong to our own galactic or milky way system, a huge conglomeration of stars, clusters and gaseous bodies, 100,000 light years in diameter and about 20,000 light years thick at the center. It is only one among billions of others like it scattered about in a great universe of galaxies that extends at least 100,000,000 light years in every direction. Do the same laws apply in these distant galaxies or spiral nebulae?

This is a much harder question to answer than any of the others, and the answer can not yet be regarded as complete. We believe that our own nebula or galaxy is revolving, but it takes 200,000 years to make one turn. Motions have been observed in our neighboring galaxy, Andromeda, only 870,000 light years away, which might be part of such a revolution, but it is too early to say.

Strangely enough, Dr. Zwicky finds the best evidence for the operation of gravity over inter-galactic distances, measured in millions of light years instead of millions of miles as in our solar system, in certain clusters of nebulae that occur. Imagine, a cluster of universes each one like our great milky way! One of these in the constellation of Coma is 45,000,000 light years distant and about 5,000,000 light years in diameter. Dr. Zwicky estimates that it contains over 2,000 galaxies; 650 have been counted.

The distribution of these galaxies within the sphere they occupy can be calculated on the basis of Newton's law of gravitation, and Dr. Zwicky finds that the actual distribution corresponds very nearly with that predicted by the law. Incidentally these clusters of nebulae could not have settled down to their present state in the short time of less than 10,000,000,000 years allowed by the advocates of the expanding universe. Besides supporting the general validity of Newton's law of gravitation, he says they also suggest that the universe is not expanding.

ECLIPSE OF THE STAR ALDEBARAN

IF, during the night of Monday, October 26, you see the moon, a few days past the full phase, approaching the bright star Aldebaran in the constellation of Taurus the bull, just keep on watching. You will be rewarded with a view of an occultation, which is what the astronomer calls an "eclipse" of a star by the moon.

The moon moves around the sky once a month from west to east. From new to full, the dark side is ahead, and from full to new the bright limb, on which the sun is shining, is in advance. Consequently when Aldebaran is occulted, the bright edge will cover the star. A pair of binoculars will make it easier to see. When, an hour or so later, the star emerges, its reappearance will be from behind the dark part of the moon. It will disappear and return to view instantaneously. There is no atmospheric layer around the moon to cause partial absorption of the star's light, and to make the star brighten gradually as the eclipse ends.

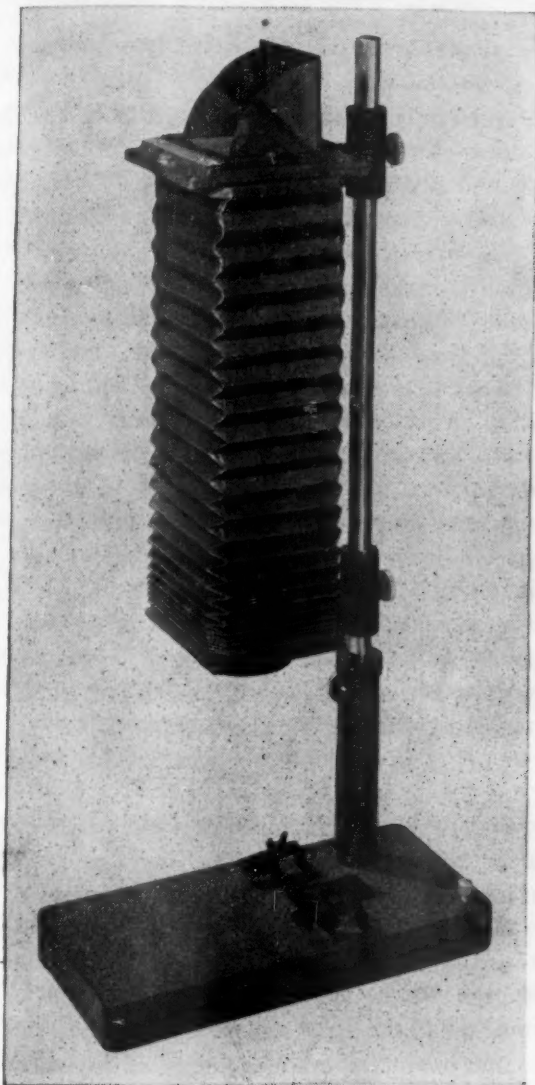
The exact times of the occultation are different in different parts of the country, but the Nautical Almanac Office of the U. S. Naval Observatory has worked them out for Washington and for three other stations. For Washington, the star disappears (on Oct. 27) at 2:11 A.M., EWT, and reappears at 3:37, EWT. For a location in western Massachusetts, the times are 2:23 and 3:51 A.M., EWT. For southern Illinois they are 12:46 and 2:11 A.M., CWT. Southern California will see the occultation start at 10:17 P.M., PWT, and end at 11:21 P.M., PWT, on the 26th.

Astronomers will watch this, as they do other occultations, in order to time it and to check accurately the movements of the moon. Occultations occur nightly, but those of a bright star are considerably rarer. Aldebaran is the brightest star that can ever be occulted.

ALLOYS OF METALS

A NEW method of making alloys of metals that do not mix when melted, and therefore can not be alloyed in this manner, was described at the Cleveland meeting of the American Society for Metals in a paper by M. L. Samuels, A. R. Elsea and K. Grube, research metallurgists of the Battelle Memorial Institute of Columbus, Ohio.

For example, aluminum and lead when melted do not dissolve in each other. However well the mixture is stirred, when it solidifies nearly all the lead is found at the bottom and nearly all the aluminum on the top, since lead is more than four times as heavy as aluminum.



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But aluminum and tin do mix well when melted. On cooling, the aluminum, having the higher melting point, solidifies first in tree-like forms that interlace throughout the mixture. The spaces between are filled with the still molten tin. On further cooling, the tin solidifies and an alloy is produced in which the two metals are well and uniformly mixed throughout the mass.

It was found that this aluminum-tin alloy can be converted into an equally good aluminum-lead alloy by displacing the tin with lead. To do this, the alloy is heated in a pot to a temperature which melts the tin but not the aluminum. Molten lead is then poured on the top, and seeps into the metal, pushing the tin before it. The latter runs out through a hole in the bottom of the pot. In this way, an aluminum-lead alloy is produced having the same intermixture of metals that the aluminum-tin alloy had.

The method is applicable not only to metals that do not mix at all, but also to those that do not mix well enough to produce a good alloy, thus opening the way to improving these alloys. Thus copper and tin, when the tin content is high, do not mix well. By first making an alloy of copper and bismuth, and later replacing the bismuth with tin, a superior and hard alloy was produced. In fact, a number of impossible alloys were produced and several difficult ones were improved.

MAHOGANY TREES

MAHOGANY may come from cultivated forests of African trees grown in Florida. Experimental plantings of Rhodesian mahogany trees on the grounds of the subtropical experiment station of the University of Florida, near Homestead, are catching up in height with native fast-growing pines twice their age, have trunks twice the diameter of pines as old as themselves, and appear to be forming wood four or five times as fast.

On the strength of this performance, S. J. Lynch and H. S. Wolfe, of the Experiment Station staff, express the opinion that they appear to be the most promising hardwoods for reforestation in South Florida that have been tested by the Sub-Tropical Experiment Station.

The trees belong to one of two African genera of mahoganies, and are known botanically as *Khaya nyasica*. To distinguish them from other African mahogany species, it is proposed to call this species East African or Rhodesian mahogany. The African mahoganies generally are closely related to the American genus, *Swietenia*.

The oldest trees in the plantings, although set out in rather unpromising-looking sites only twelve years ago, already have seven- to eight-inch trunks and average 40 feet in height. Although distinctly tropical in origin, they have survived several cold spells, including one freeze when the temperature dropped to 27 degrees Fahrenheit. So far, the trees have not been attacked by insect pests or diseases; but botanists are chary about claiming immunity for them on that score.

RED AND VIOLET SNOW

FIELDS of red and purple snow in the Northland are due to microscopic plants. These single-celled algae, one of the most primitive groups of living things, were investigated by Erzsébet Kol, a Hungarian woman working under a Smithsonian fellowship. Her report of the vivid

"blooms" in Alaskan mountain ranges has been published by the Smithsonian Institution. In this forbidding Arctic environment, she found nearly fifty examples of the tiny plants living in almost infinite numbers on perpetual ice and snow.

After collecting living specimens, Miss Kol went to her laboratory high in the Swiss Alps where she planned to cultivate and study this strange form of life. War has now severed communication with her. Except for news of the loss of her living specimens, no word has been received on how the war has affected the project.

Previous reports indicated that these algae vary in character. One wouldn't live on ice; another wouldn't live on snow. And there are striking changes in types, depending on whether surrounding mountain slopes are acid or alkaline in composition. This is probably due to their reliance on air-borne particles of decomposing and shattered rock for food. Dust dissolves slowly in the moisture on snow or ice surfaces, providing the minerals essential for life.

The snow and ice plants, it is believed, serve as the chief food for some other form of life, which in turn supports higher forms. However, the life cycle of the vividly colored organisms remains unknown.

INDIAN SUMMER

THE first sharp frosts came early this year over a wide stretch of this country; Indian summer is here correspondingly soon. The quiet, warm autumn days, with calm air or, at most, moderate, drying winds, are good for hastening the maturing of the crops. They dry the last surplus water out of corn, beans and other seed crops, mellow late apples and pears, and put the finishing touches on pumpkins and hard-shelled squashes left orphans by their frost-killed vines.

There is no fixed date for the arrival of Indian summer, no definite duration for the season. It is not even necessary that a killing frost come first, though that is a usual preliminary. Any warm, quiet spell, following cool or chill fall weather, may be called Indian summer. In some fortunate falls there may be more than one such season.

Meteorological background for Indian summer is a "stalled" high-pressure area somewhere in the Southeast, with a large area of low pressure backed up in or near the Yukon valley. There will then be little air movement off the main body of the continent, and even the low-angled autumn sun can warm up the air. Sometimes Indian summer temperatures rival those of actual summer: 90-degree days are not uncommon, though nights are always cool.

Only in the English-speaking parts of North America is the name Indian summer used. Similar seasons in Europe have names dating back to the Middle Ages, ascribing them to various autumnal saints; usually St. Martin, whose feast comes on November 11. The ancient Greeks had a belief that these calm spells were a gift of the gods for the special benefit of the kingfisher, whose name in Greek is halcyon. The kingfisher was supposed to build a floating nest on the sea, and to sing sweetly to its brood; whence the phrase "halcyon days." Actually of course the kingfisher builds its nest in a burrow

in the stream or lake bank, and is not at all notable for vocal virtuosity. However, that's just some more of cold-blooded modern science's upsetting of pleasant old fancies.

The glistening gossamer threads that float through the air and catch on trees and shrubbery during Indian summer are a source of mystery to many persons. They look just like spiderweb, only you don't see any spiders. Actually they are spiderwebs, and if you look sharp at the right time, you may see the spiders. But as a rule you'll have to get up fairly early, and on just the right days. Very tiny spiders, recently hatched, climb out on the ends of twigs when very gentle air-warmed currents are rising. They spin these thin threads each with a tiny parachute-like tuft at its end. When the lift becomes great enough, away they sail, seeking their fortunes like true Argonaut adventurers. It is the method of migration-dispersal followed by these spider species.

These glistening threads, too, were the source of an old folk-belief. It very likely is older than Christianity; but at present, and for many generations past, peasants in the Catholic parts of Europe call them various names that all translate as "Mary's threads." Because they are so delicate, and perhaps because they have a bluish glint in the autumn sunlight, they are supposed to be ravelings from Our Lady's veil, drifting down like a benediction on a quiet world.—FRANK THONE.

ROUNDING UP ANTELOPES

PRONGHORN antelope, the fastest things that run on four legs on this continent, have been very successfully rounded up by airplane, for transplantation in trucks to new places on the range. In the *Journal of Wildlife Management*, Lee William Fisher, of the Texas Game, Fish and Oyster Commission, tells how, in illustrated detail.

Pronghorn transplantation is desirable, Mr. Fisher explains, because while the fleet little animals get along excellently with cattle on their range, they simply don't "mix" with sheep. So it is the practice so far as possible to remove them from sheep country and release them on cattle lands, where they are welcome.

The first round-ups of pronghorn in Texas were carried out by men on horseback. However, the method proved slow and rather costly. Mr. Fisher had noticed, during airplane flights made for the purpose of counting pronghorn herds, that the animals would run away from the sound of the motor. So he tried some experiments, and soon learned that small pronghorn herds could be bunched into one big herd, and then "drifted" in any desired direction, by flying a plane on the opposite side, at heights between 50 and 500 feet. A small, low-powered, slow-speed plane was found most suitable for the purpose, as well as very economical to operate. The herds are "drifted" into a big wire corral, and driven from that into a smaller pen made of strong cord. From this they are removed and examined, weighed and loaded into trucks for transportation to their new homes.

Since adoption of this method, 467 animals have been trapped and transported, with a loss of only three killed. The whole cost for each animal was only about \$4.30.

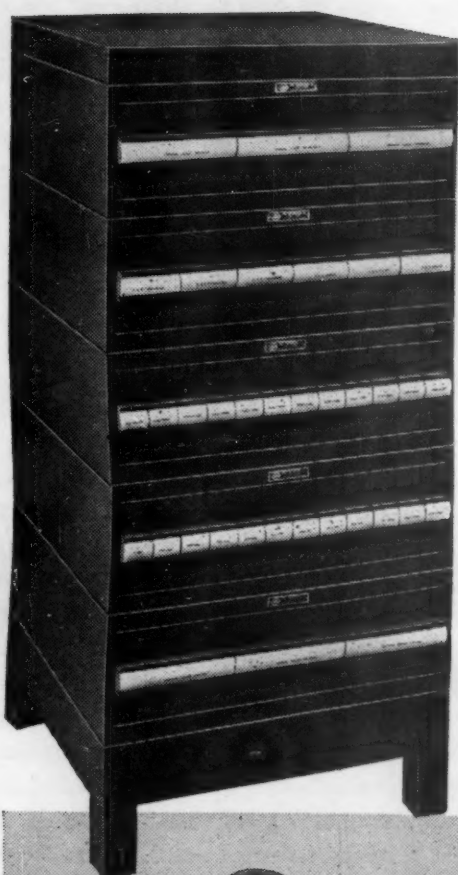
ITEMS

TYROTHRICIN, a potent germ-killing substance obtained from bacilli that live in the soil, has been tried with "discouraging" results in sinus disease and infections of the nose and throat of the kind most laymen refer to as colds. Use of the substance in these conditions and its apparent failure in general to benefit the patients was reported by Dr. J. R. Lindsay, of Chicago, at the meeting of the American Academy of Ophthalmology and Otolaryngology. Tyrothricin is the crude substance isolated by Dr. René Dubos, at the Rockefeller Institute, and contains two crystalline substances, gramicidin and tyrocidine. Gramicidin has been hailed as an important new chemical remedy for diseases caused by germs of the gram negative group. Dr. Lindsay's experience with the parent substance, tyrothricin, shows one group of infections for which it is ineffective. Tyrothricin can not be given by injection, because it must be kept out of the blood stream since it separates hemoglobin from the red blood cells. So Dr. Lindsay used it in the nose, throat and sinuses by spraying, swabbing and dropping.

HOPE for doubling the nation's stockpile of morphine through use of a potentiating drug is discouraged by research, reported by Dr. Howard L. Andrews, U. S. Public Health Service, in the *Journal of the American Medical Association*. By giving prostigmine methylsulfate with morphine, it had previously been reported that pain could be relieved with only about half the amount of morphine usually required when given alone. Besides conserving morphine, this potentiating drug might also reduce the risk of morphine addiction developing from morphine given to relieve pain. As a result of studies at the U. S. Public Health Service Hospital at Lexington, Ky., where narcotic drug addicts are treated, Dr. Andrews concludes: "It appears that the combination morphine-prostigmine methylsulfate is not significantly more effective in raising the pain threshold than morphine alone and that the addition of prostigmine methylsulfate does not appreciably change the rate at which tolerance is developed."

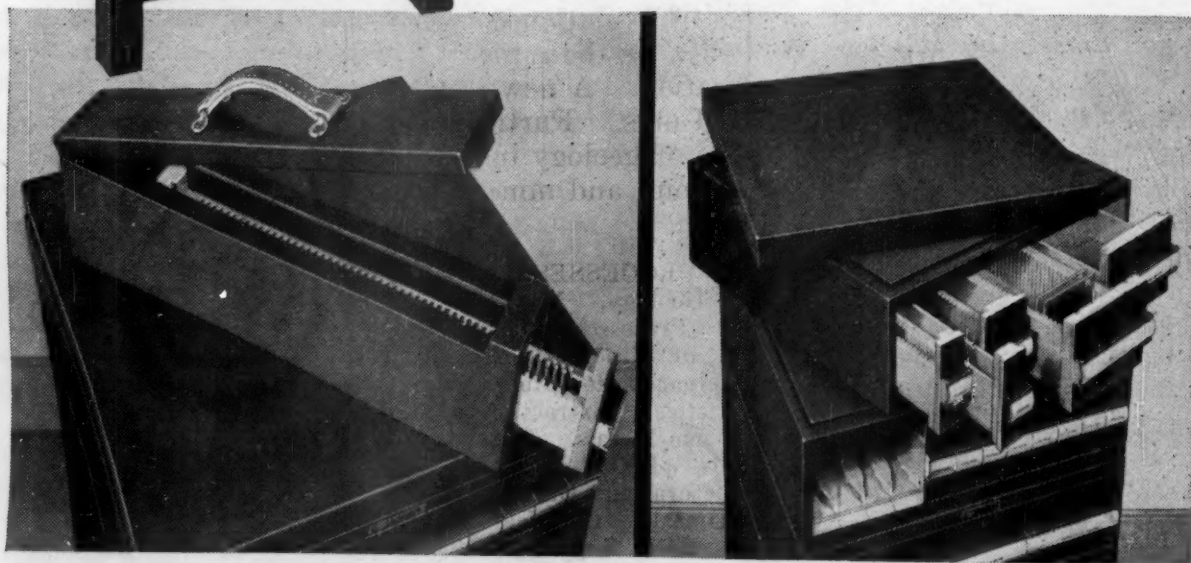
PINK-FLESHED trout, and presumably other fish also, contain more vitamin A than white-fleshed trout, according to preliminary experiments made by Dr. C. H. Clausen, of the University of Colorado School of Medicine. His discovery came in studies undertaken at the request of Director C. N. Feast, of the Colorado Game and Fish Department, who wanted to know why flesh of the same sort of fish, such as brook or rainbow trout, may graduate from white to a deep clear pink. The pink flesh contains more vitamin A than the white flesh, and Dr. Clausen also found more vitamin A in the flesh of crustacea, main food of the trout, which lived where the pink-fleshed fish do. Dr. C. E. Hagie, educational manager of the department, points out that foods rich in vitamin A, fed to trout in ponds where they are reared tame for the table, may help pond-owners produce only pink-fleshed fish, which are considered more attractive, as red salmon are considered more attractive than those with paler meat. The experiments are being continued.

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The book constitutes a complete treatise on the subject of economic mineral deposits. Emphasis is placed upon processes of formation of mineral deposits. The content includes worldwide deposits, rather than merely those of the United States; it thus represents a ready reference to all important deposits.

A new and adequate textbook treatment of oxidation, gossans, and supergene enrichment is given. There is also a detailed discussion of the mineral-forming processes of sedimentation, evaporation, and residual concentration. A new treatment of magmatic ores is given, with details of relations of magmas and ores. Further, the book gives practical geologic applications of theory, such as the value of geology in prospecting, the importance of minerals in industry and international relations, and mineral resources. A treatment of non-metallies in industrial use groups is given.

CONTENTS—PART I. PRINCIPLES AND PROCESSES. Introduction. Brief History of the Use of Minerals and of the Development of Economic Geology. Materials of Mineral Deposits and Their Formation. Magmas, Rocks, and Mineral Deposits. Processes of Formation of Mineral Deposits. Controls of Mineral Localization. Folding and Faulting of Mineral Deposits. Classifications of Mineral Deposits. Resources, International Relations, and Conservation in Minerals. Geology in Prospecting, Exploration, Development, and Valuation of Mineral Properties. Extraction of Metals and Minerals. **PART II. METALLIC MINERAL DEPOSITS.** The Precious Metals. The Nonferrous Metals. Iron and Ferroalloy Metals. Minor Metals and Related Nonmetals. **PART III. NONMETALLIC MINERAL DEPOSITS.** The Mineral Fuels. Ceramic Materials. Structural and Building Materials. Metallurgical and Refractory Materials. Industrial and Manufacturing Materials. Chemical Minerals. Fertilizer Minerals. Abrasives and Abrasive Minerals. Gemstones. Ground Water Supplies. **INDEX.**

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SCIENCE NEWS

Science Service, Washington, D. C.

DANGERS CONNECTED WITH THE
HANDLING OF METALS

A GRAPHIC description of the dangers connected with the handling of metals in American industry and the suggestion of an eight-point program to eliminate them were made by Dr. Robert A. Kehoe, of the University of Cincinnati College of Medicine, at the New Haven meeting on Industrial Health and Medicine in Wartime in the Yale School of Medicine.

"In a large measure this is a war of metals," said Dr. Kehoe, "and metals are being used increasingly for the weapons of war, the machinery to make those weapons and in chemicals for certain purposes. The toxicity of metals is not always well understood, but it is at least clear that some metals combine with the essential components of protoplasm, thus interfering with the workings of body cells. Some metals are poisonous because they form volatile chemical compounds which can be inhaled in high concentrations, notably arsine from arsenic. Others are poisonous because they are readily soluble in watery liquids and dissolve readily in the intestinal juices, becoming easily absorbed in the bloodstream. Again, a metal often occurs in combination with a more toxic substance and may be less hazardous than its partner—for examples, lead arsenate."

It was pointed out that once metals are inside the system, they are redistributed throughout the body in certain organs. Among these the liver is preeminent and in the case of more prolonged storage, the bony skeleton may become the most important storage depot. How long metals remain stored depends on a number of factors, including rates of breakdown of chemical compounds, rate of metabolic renewal of the tissue involved, and the form in which the poison occurs. Variations in the poisonous effect of metals depend on abnormally high concentrations, marked individual differences among men and the type of compound in which the metal occurs.

Dr. Kehoe outlined means of measuring the degree of exposures in terms of the toxic metal concentration, correlating these measurements with physiological effects and finding the established limits of safety. He said that exposure can be controlled with the following eight practices: (1) plant design to segregate more hazardous operations; (2) enclosed operations and properly designed equipment; (3) adequate ventilation with air-conditioning wherever possible; (4) housekeeping and maintenance; (5) protective equipment and sanitation; (6) instruction and regulations; (7) supervision of work and workmen; (8) general hygienic instruction of workmen.

DEHYDRATED FOODS

STRIDES in the dehydrated food industry were described recently by Dr. Samuel C. Prescott, dean emeritus of Massachusetts Institute of Technology, at the school conducted for operators, foremen, and plant managers by the Department of Agriculture at the Western Regional Research Laboratory.

"The War Department," he said, "has already purchased or contracted for nearly a hundred million pounds of dehydrated vegetables. Not only is this tremendous increase in the dehydration of foods a part of the war effort, but it is potentially a great and useful industry which will continue after the war."

The story of the development of dehydrating foods has been a history of emergencies. Dehydrated vegetables were first used in the Civil War when soup mixtures were given the troops to prevent scurvy. In 1886 a small plant to dehydrate vegetables was started in Australia to supply miners and explorers. About ten years later there was some interest in dehydrated foods in this country because of the needs of the miners in the Klondike gold rush.

During the Spanish-American War dehydrated potatoes were bought in considerable quantity for the navy. Soon after this the battleship *Oregon*, similarly supplied, made a trip around the world. "I saw some of the potatoes that went on that trip," Dr. Prescott said, "they were the color of a good brown derby."

In the Boer War troops sent to South Africa were supplied with dehydrated vegetables for soup mixtures. Some of these, packed in paraffined barrels, were kept until the World War and served to the British troops nearly fifteen years later.

In 1910 the United States had only a few kitchen-size dehydration plants. The World War gave a great impetus to the industry. The Navy, remembering the experience of the *Oregon*, refused to buy any considerable quantity of dehydrated vegetables, but the Army ordered many thousand tons. The products varied greatly in quality; some were good, others were "case-hardened," some scorched, and some not thoroughly dried. However the need was great and all were sent to France. This poor quality caused a prejudice against all dehydrated foods which retarded the further development of the industry. But some products were excellent even in 1919. At a dinner that year, served to 200 members of the American Society of Bacteriologists, no one was aware that the whole meal—with the exception of the roast, the rolls, and the ice cream—was prepared from dehydrated food.

In Germany the development far exceeded our own. Beginning with one small plant in 1898, we find 199 in 1909, and 1,900 in 1917 in which the total quantity of dried potatoes alone was equal to three times our annual crop.

During recent years and especially since 1940 under the stimulus of the Government Dehydration Committee, there has been a great increase in knowledge and interest. The best products—which include numerous varieties of vegetables—are practically equal to fresh ones in flavor, texture and nutrition.

The government hopes that by means of large scale inspection of plants, and by schools such as the Western Regional Research Laboratory, our fighting forces will be



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A NUTRITIOUS SOUP

THE latest addition to large-scale, low cost, high nourishment feeding is a three-cent soup mix announced by Dr. Robert S. Harris, of the Massachusetts Institute of Technology, at the Detroit meeting of the American Dietetic Association.

Made of skim milk powder, peanut flour, soya flour and peas, the soup mixture is inherently rich in good protein and in vitamins of the B complex. It will be possible to supplement it with minerals and with natural and synthetic vitamins so that each ounce can supply the full day's allowance of these diet essentials. A full day's portion can be supplied at a cost of two to three cents.

The mixture is ready to serve, so it is not subjected to the destructive effects of cooking. All the materials are available in large quantities which will make it possible for the soup to be used on a national or international scale. Used as a stock to which meat and vegetables may be added, it provides the possibility of great variety in a school-lunch menu.

A field study conducted in six schools in small communities in Michigan showed that the soup was palatable as 426 children consumed it daily for three months and showed no evidence of tiring of it. There were significant improvements in the group to which the soup was given in comparison with the control group who ate the usual school lunch. These improvements included a better ascorbic acid (vitamin C) and iron status and some improvement in weight and riboflavin status. The study showed that the hot school lunch previously supplied was not properly supplementing the home dietary.

SCARLET FEVER

THE most important factor in the making of a scarlet fever epidemic in any community is the condition of the environment and specifically the number of persons in the community carrying scarlet fever germs, according to a report made by Dr. Francis F. Schwentker and Dr. John H. Janney, of the Rockefeller Foundation, New York, to the St. Louis meeting of the American Public Health Association.

Over the world all the twenty-six serological types of germs belonging to the group A streptococci family have been isolated from patients with scarlet fever. In any single community, however, the sporadic cases are due to only a few types, and epidemic cases to only one type.

Strains capable of causing scarlet fever, called scarlatinogenic, are present sometimes in communities free from the disease, which raises the question, what causes an epidemic to start? The question is answered as follows:

"For scarlet fever to occur in a community, a scarlatinogenic strain of streptococcus must be present or introduced. The number of cases of infection which follow depends on the distribution factor as measured by the carrier rate. Low carrier rates mean only sporadic cases; high rates accompany epidemics.

"A part of the population are never reached by the

streptococcus. These naturally remain well. Of the others who become infected, some have antibacterial immunity; they either eliminate the organism immediately or become healthy carriers.

"Those without antibacterial immunity become ill; the kind of illness is determined by the antitoxic immunity. If immune, the patient develops streptococcal tonsillitis; if not, scarlet fever. Other diseases such as erysipelas and puerperal fever may result with portals of entry other than the throat."

ITEMS

U. S. DEPARTMENT of Agriculture entomologists have discovered three ways to destroy the dog flies that menaced soldiers and construction workers at army camps in coastal areas. The methods are: spraying marine grass with dilute creosote oil; dipping celery waste, and burying peanut litter. The shoal and turtle grass on the shores of bays and sounds, the litter left after baling peanut vines for hay and the dump piles of waste stripings from celery washing plants all had previously been "fly factories." Dog flies do not carry disease to man, but their painful, stinging bites are enough of a nuisance to reduce efficiency 20 or 25 per cent., according to a statement made by the U. S. Department of Agriculture. Since the fly population has been reduced, contractors report increased efficiency of workers and estimate a savings at two camps alone of about \$500,000. The dog fly is a serious pest to cattle. In 1939 owners of livestock in one coastal area reported that one fifth of their cattle died from loss of blood, hunger and weakness resulting from annoyance by this pest. In efforts to escape the flies, cattle rush into the mud and water of swamps, and become mired so that they are often unable to free themselves.

THE source of the petroleum from which industrial solvents, such as benzene, gasoline and solvent naphtha, are obtained plays a part in determining the possible injurious action of these chemicals on those who work with them. This is one part of the "lesson" Dr. W. F. Von Oettingen, principal industrial toxicologist for the U. S. Public Health Service, gave a group of fifty Connecticut physicians attending the opening class of the new course on "Industrial Health and Medicine in War Time" given at the Yale School of Medicine. The increasing use of hydrocarbons in war industries is creating new health hazards. The appraisal of these hydrocarbons offers considerable difficulties because most of these solvents represent mixtures, sometimes of heterogeneous nature, and because their composition is often only incompletely known. Certain solvents such as benzene, gasoline and solvent naphtha, may vary with regard to their chemical composition according to the source of the petroleum from which they are obtained and therefore vary also with respect to their injurious action. Dr. Von Oettingen suggested that the older method of describing these substances in terms of their physical properties failed adequately to indicate their potential injurious effects. Therefore, he suggests that appropriate chemical analysis be made in order to detect possible noxious components.

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SCIENCE NEWS

Science Service, Washington, D. C.

U. S. LEADERSHIP IN HEALTH PROTECTION

THE United States is in danger of losing, if she has not already lost, her position as leader in health protection for the people of the western hemisphere, according to a report by Dr. Thomas Parran, surgeon general of the U. S. Public Health Service, at the St. Louis meeting of the American Public Health Association, who gave the result of his findings on his visits to Mexico and to the Pan-American sanitary conference in Rio de Janeiro.

When air travel between North and South America was instituted some years ago, the United States was greatly concerned over the possibility that yellow fever would be reintroduced to the country from South America. Now Brazil is rightly exercised and has made representations to our State Department because yellow fever mosquitoes and even the tse-tse fly, carrier of deadly African sleeping sickness, have been found on American airplanes entering Brazilian ports from Africa.

The Brazilian government, at a cost of \$2,000,000 and with aid from the Rockefeller Foundation, which spent \$200,000, has eradicated both African and American yellow fever mosquitoes from all her port cities and from eight of her states. Dr. Parran stated that only one United States port, Miami, Fla., had done anything like this.

Americans need to recognize that continental health security and solid Pan-Americanism run on a two-way track. Brazil's vast accomplishment in wiping out yellow fever danger in her cities and states does not remove the danger of yellow fever striking Brazilians or other Americans unless we and other American nations wipe out the yellow fever danger within our own boundaries.

NUTRITION IN GREAT BRITAIN

COMFORT for Americans disturbed by the prospect of one cup of sugarless coffee per day, at least one meatless day per week and probable restrictions in butter and in variety of vegetables was given in a report to the association by Sir John Boyd Orr, director of Great Britain's Imperial Bureau of Nutrition.

Britain in the fourth year of war is down to something like iron rations, with all luxury foods cut out, but the diet of the people in Britain from the viewpoint of health is about as good as it was before the war. There are no signs of malnutrition, and child health is actually better than before the war. Wealthy people are eating about a third less food than before the war, while the poor are getting diets much richer in vitamins and minerals. Drastic changes in the national diet have been brought about with almost complete absence of grumbling. There is no food hoarding; it is definitely not the thing to do, according to universal public opinion.

Britain has won the war on the food front partly through lend-lease shipments of food from America, for which Sir John expressed heartfelt gratitude to the United States and Canada, and partly through greatly increased

production of food and milk at home. The amount of land under the plow is now 50 per cent. greater, representing an increase of six million acres, than it was before the war, when two thirds of the food was imported. There appears to be no farm labor man-power problem in Britain. Men, women and children all work in their gardens and allotments after they have finished their day's work in factories, offices and schools.

England intends to win the peace on the food front by keeping home production up to a two thirds increase. Sir John pointed out that America must increase her food production greatly if she and the British commonwealth of nations are to avoid post-war defeat on the food front. —JANE STAFFORD.

TOOTH DECAY AND PLACE OF RESIDENCE

THE best teeth in the nation, at least among children and men of military age, are found in Arkansas and the South and Southwest generally, was stated by Dr. Bion R. East, dentist and public health professor of the College of Physicians and Surgeons, Columbia University.

The worst teeth are found in New England, Dr. East reported after studying draft records of the 1918 Army, the 1863-1864 Federal Army and the preliminary figures from the 1940-1942 draft. The 1918 records showed that when measured by the Army's standards, the teeth of the men of Vermont were thirty-five times poorer than those of Arkansas. Missouri rated high in excellence of its men's teeth in 1918. Study of draft rejections then showed that only three states in the nation had lower rejection rates for dental defects than did Missouri.

"The probability that the reported differences were not due to chance," Dr. East stated, "is strengthened by similar results obtained in a survey made of U. S. Navy recruits of 1934. In that survey the New England men, when compared with those of other sections of the country, also had the most evidence of past and present tooth decay. Arkansas, the state with the lowest rejection rate for dental defects in the draft of 1918, had the best record in this respect in the Navy's survey of 1934.

"Preliminary reports from the drafts of 1940-42 suggest that marked variations in the magnitude of the rejection rates for dental defects will again prevail among the different states. The indications are that New England will again lead the rest of the country in the percentage of men rejected for military service for poor teeth and that the men of the southern and southwestern states will again have the low rates. Similar trends in the distribution of tooth decay were found in dental surveys of children residing in different states."

Reasons for the relation between tooth decay and place of residence were not given by Dr. East, but his findings coincide with earlier findings of U. S. Public Health Service scientists on the relation of fluorine in the drinking water, mottled enamel and tooth decay. Fluorine in drinking water and the mottled enamel it causes are both prevalent in the Southwest, but the mottled enamel teeth

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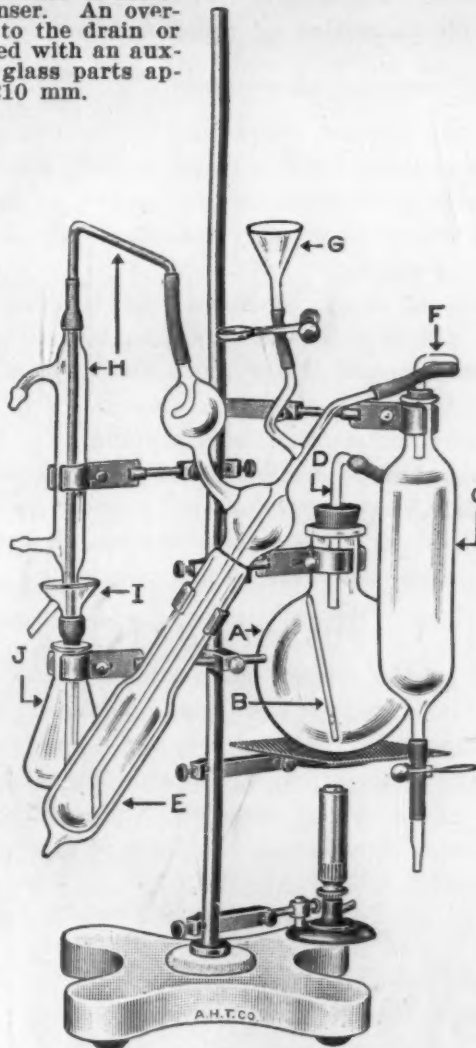
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rarely decay. New England water supplies, so far as they have been tested, are fluorine-free.—JANE STAFFORD.

A TYPHOID FEVER VACCINE

A STEP toward development of a more powerful anti-typhoid fever vaccine has been taken in research by Dr. Jules Freund, New York City Health Department Bureau of Laboratories. Results so far of Dr. Freund's work on both typhoid and diphtheria are announced in the first annual report of the Public Health Research Institute of New York City issued by Dr. Otto A. Bessey, director of the institute.

By injecting killed tuberculosis germs and lanolin-like substances into animals, Dr. Freund has discovered, their production of typhoid fever-fighting anti-bodies is increased in response to invading typhoid germs.

"In a way, this means production of a more potent vaccine against typhoid," Dr. Thomas Rivers, director of the Hospital of the Rockefeller Institute and now Commander in the Medical Reserve Corps, U. S. Navy, as well as chairman of the institute's scientific council, explains.

"Whether this method actually gives a more potent vaccine for protection of people against typhoid fever, however, can not be stated until field experiments have been made."

Efforts to increase the potency of diphtheria toxoid by the same methods are now being made by Dr. Freund.

Nutrition studies are another project of the institute, which is said to be the only municipal organization of its kind in the world.

Nutritional assays of foods sold in New York City markets will be undertaken in order to find out whether, when the housewife buys foods for their vitamins and minerals, the foods contain the amounts of these essential diet factors she expects them to contain on the basis of food value tables. Meat, vegetables and other foods may vary widely in their vitamin and mineral content according to their region of growth because of the differences in soils in various parts of the country.

PULSATING STARS

STARS of the strange class known as RV Tauri-type pulsate in fundamentals and overtones. Dr. Cecilia Payne-Gaposchkin, of the Harvard Observatory, speaking before the Association of Variable Star Observers, described her method of using organ pipes to correlate the vibrations of air columns with those of gigantic stars far off in space.

Only 29 RV Tauri-type stars are known, but there were only 13 known in 1927, so they are being found rather frequently. They are stars whose light fluctuations are extremely variable. Their light becomes very much fainter than normal at intervals, but about in the middle of these intervals, they do a less noticeable dimout. However, these "primary" and "secondary" minimums of light sometimes change places in the RV Tauri stars, and sometimes some of them seem more like Cepheids, another class of variable star which is much more abundant. Cepheid variables are pulsaters, and they undergo their alternate contractions and expansions at regular intervals—the principle of harmonic vibrations, well known to

musicians, has been successfully applied to them by Dr. Martin Schwarzschild, of Columbia University Observatory.

But the RV Tauri sometimes vibrate in their fundamental tone and sometimes in the first overtone or harmonic. They may change back and forth at will, thereby producing hitherto unexplainable changes in their light fluctuations. The Cepheids resemble the heavy and low note of the long pipes; the so-called Cluster variables to the short high-pitched notes; while the RV Tauri stars were in between, giving pleasant tones of one octave separation.

All such vibrating variable stars are known to be considerably larger and brighter than our sun, which is a "dwarf" star of comparatively quiet habits—to our good fortune.

ITEMS

MOTORS and trucks now doing essential service on our highways can be operated a longer time without reconditioning by the use of expander type piston rings, P. E. Friend, of the Wilkening Manufacturing Company, told the Society of Automotive Engineers meeting in New York. Plane non-expander piston rings, Mr. Friend said, work all right so long as the cylinder is round and straight. But so soon as it is worn a little more in some spots than in others—is no longer truly circular or straight up and down—the ordinary ring fails in its function because it rides over the irregularities. The expander type, he explained, is more flexible and has inner springs which exert independent pressure against every part of the cylinder, so that the ring conforms to the variations in the contour of the cylinder wall. Consequently a worn cylinder can be used much longer, and because of the flexibility of the ring, there is less wear in the first place. At least six engine manufacturers, he said, are supplying these rings as original equipment, and many others buy them and stock them for replacement service.

THAT the cause of death in asthma and some kinds of pneumonia is a metamorphosis of the lining of the bronchial tubes which makes them bald instead of hairy was announced by Dr. A. C. Hilding, of Duluth, Minn., at the Chicago meeting of the American Academy of Ophthalmology and Otolaryngology. The fine hairs, called cilia, which are normally present in the lining of the bronchial tubes can readily and easily remove mucous secretions. But in the cases Dr. Hilding studied, the hairy lining of the tubes had changed into another kind of tissue which had no hairs. Consequently the thick mucous substance accumulated in the tubes and the patients died of asphyxiation. Aggravating the difficulty is the fact that the changed and bald cells themselves produce a secretion which they only partly extrude. This fuses with the general mass of secretion but remains anchored to the cells lining the bronchial tubes, thus aggravating the difficulty of emptying the bronchial tract. "The ciliary mechanism," Dr. Hilding reported, "is also more or less completely incapacitated in bronchopneumonia, bronchiectasis and influenzal pneumonia. Loss of function is doubtless an important factor in the progress of these diseases."

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SCIENCE NEWS

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THE THREE HUNDREDTH ANNIVERSARY OF NEWTON'S BIRTH

SIR ISAAC NEWTON, known to every one for his universal law of gravitation, was born on Christmas day in the year 1642. Naturally we should suppose that Christmas day, 1942, would mark the three hundredth anniversary of his birth. But it is pointed out in the *Journal* of the British Astronomical Association (March) that December 25, 1642, was the date of Newton's birth according to the Old Style or Julian calendar then in use in England. According to the New Style or Gregorian calendar now in use, the date was January 4, 1643, and it is planned to celebrate the anniversary next year.

But is this correct? There can be some doubts about it. It is true that the day Newton was born was designated January 4 by the Catholic countries which had adopted the Gregorian calendar in 1582, at which time, by order of the Pope, ten days were dropped out. But by the time the new calendar was adopted in England in 1752, another day had vanished, because the year 1700 was a leap year in England but not in the Catholic countries. In fact, when the British switched to the new style they dropped eleven days. That would shift the anniversary to January 5.

But there is more. The years 1800 and 1900, which would have been leap years by the old reckoning, were not by the new. Thus two more days have evaporated, and the new calendar is now thirteen days ahead of the old. Thus the Soviet Government when they adopted the new calendar dropped thirteen days, which put the "October Revolution" into November. And this would boost Newton's birthday to January 7.

Thus we have four possible dates for celebration, December 25 and January 4, 5 and 7. Which shall it be?

If we insist that exactly 300 Gregorian years shall have elapsed before we can celebrate the anniversary, then January 7 is the correct date. But many will doubtless feel that since the English were actually celebrating Christmas on the day that Newton was born, it would be appropriate to celebrate his anniversary at the same festival this year, regardless of how the years have since been shortened and the dates shifted. Or, perhaps we might compromise by celebrating so great an event, which has so benefited the world, from Christmas to Twelfth Night.

The Gregorian calendar was adopted by the Catholic Church in 1582 in order to insure that the spring festival of Easter should actually occur in spring, and not get shifted back into winter, as it was already doing. Thus, in that year the vernal equinox, on which depends the date of Easter, occurred on March 11, whereas in the year 327, when the rule for reckoning Easter was established at the Council of Nicaea, the vernal equinox occurred March 21. By dropping ten days, Pope Gregory XIII restored it to that date, where, thanks to the accuracy of the Gregorian calendar, it has ever since on the average remained, and will remain for at least 20,000

years to come. At the end of that time the Gregorian calendar will be in error by only one day. Thus we are now assured that Easter will always come in spring, shortly after the vernal equinox, and Christmas will always come in winter, shortly after the winter solstice.

The Julian calendar was based on the idea that the true length of the year, or the time from one vernal equinox to the next, was exactly 365½ days. Hence every fourth year, or in years divisible by 4, an extra day was added, making a leap year. But this adds too much, because the true solar year is actually about 11 minutes short of 365½ days. The Gregorian calendar corrects this by omitting the leap year in the last year of each century. Thus 1700, 1800, 1900, although divisible by four, are not leap years. But now we have omitted too much, so it is further specified that the last year of every fourth century, or every year divisible by 400, will be a leap year. Thus 2000, 2400, 2800 will be leap years. Now we have again added too much, so it is further specified that every year divisible by 4000, that is the years 4000, 8000, 12,000, will not be leap years.

These three rules of 4, 400, and 4000 keep the calendar years now so close to the sun's years that the accumulated error in 20,000 years will not amount to more than a day.

—MORTON MOTT-SMITH.

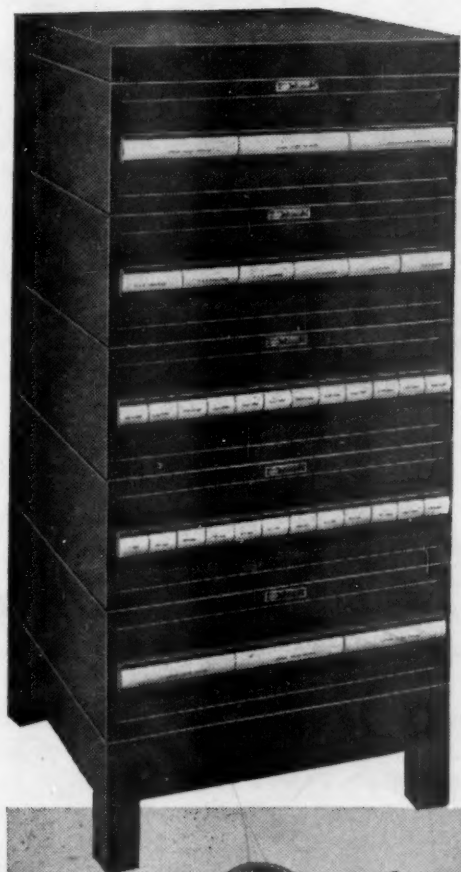
COMETS DISCOVERED IN FINLAND

APPARENTLY a cablegram sent to Harvard College Observatory last February failed to reach there, for it was not until this month that Harvard Observatory received four routine post cards mailed from the international astronomical union headquarters in Copenhagen last spring. The first of these, circular 900, tells of the discovery of a new comet by L. Oterma at Turku Observatory in Finland. The card is dated February 20, but she made the discovery on February 12. The comet was of the 15th magnitude, which puts it beyond the observation of amateur telescopes. But it is just as important to astronomers as though it were of naked eye brilliance. The other three post cards, circulars 901, 902 and 903, contain further observations of the new comet and a prediction of its future positions.

By a strange coincidence, circular 901 also contains a complete series of predicted positions for comet Schwassmann-Wachmann 1, but the European astronomers apparently overlooked it completely this September, for on September 11 the observatory at Lund, Sweden, sent a wire to Harvard that a new comet of 13th magnitude had been discovered, also by Miss Oterma. However, this turned out to be in precisely the position predicted by circular 901 for comet Schwassmann-Wachmann 1. This occasioned the remark by an American astronomer that this comet ought to carry a red flag, so often has it been mistaken for a new one.

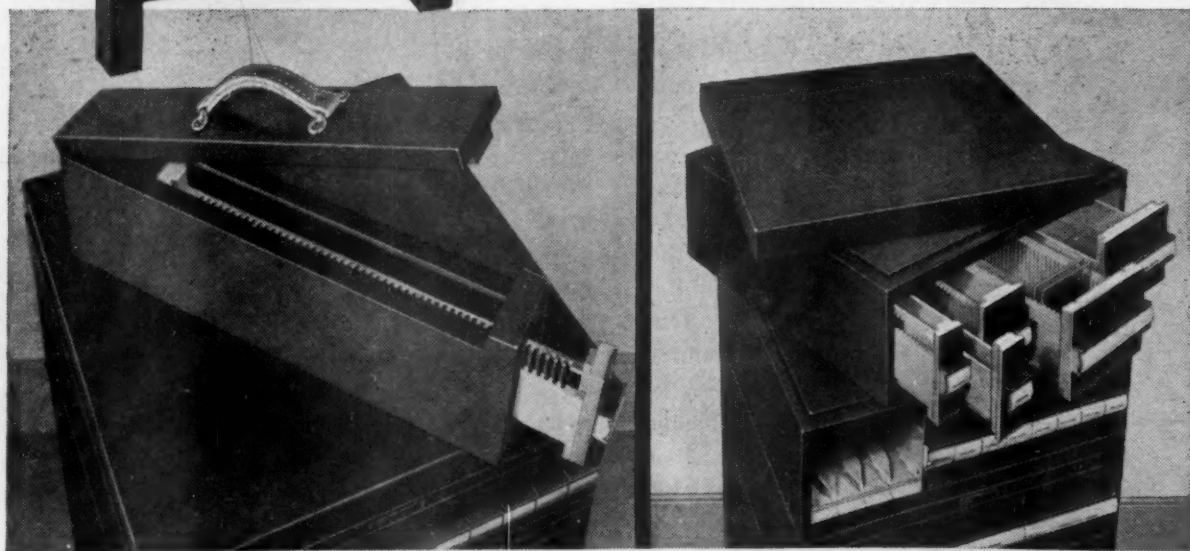
From the elements published by the Turku Observatory on the comet discovered last February, Dr. F. L. Whipple, of Harvard, computes its position to be in the constella-

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tion of Cancer, the crab, just east of the cluster which is visible to the naked eye. Cancer rises in the eastern sky about midnight during the next month.

SUGAR RATIONING

SUGAR rationing should, in the interest of national health, proceed to the point of greater restrictions on the use of sugar for candy and soft drinks, in the opinion of the Council on Foods of the American Medical Association. This opinion and reasons for it appear in a report printed in the *Journal* of the association.

The sugar we use to-day, whether from cane, beets or corn, is practically a chemically pure product. It furnishes calories but no vitamins or minerals to the diet. And modern nutritionists know that man can not live by calories alone. In fact, he can not even make fullest use of sugar and other carbohydrate calories without certain of the B vitamins. The more he dilutes the amount of these vitamins with calories from pure sugar, the worse off he is nutritionally.

The suggestion of enriching sugar with vitamins, as flour has been enriched, has not met with favor. Use of sugar to make highly nourishing foods like milk and whey more appetizing, however, is to be encouraged. When sugar is consumed, it would be well, the council advises, to take it in the form of such mixtures as cakes containing milk and eggs, in malted milk and chocolate flavored skim milk drinks, and in candies containing appreciable amounts of powdered milk and nuts.

Care should be taken to keep children from eating candy which spoils the appetite for other more nourishing foods and from substituting sweetened carbonated beverages for milk. Industrial workers who eat candy or take such beverages for between meal snacks are endangering their health because such eating may lessen by 15 per cent. the amount of more nourishing food they should be eating. Between-meal eating is useful for relieving fatigue and increasing productivity, but it should contribute to and not detract from the total daily nourishment.

COFFEE AND TEA PRODUCTION

COFFEE and tea production in this country or a satisfactory substitute is not in the offing despite recent rosy rumors born of war shortages.

Glistening white clusters of bitter crystals are dissolved in every cup of either coffee or tea—caffeine upon which Americans have depended for a physical and mental boost. This stimulating chemical has been found in at least six different families of plants in many parts of the globe. But none can be imported any more easily than coffee; none can be quickly grown here.

When you can't get coffee, however, you might be able to brew a cup of tea. It is said that a strong cup of tea is just as stimulating as a cup of coffee. Tests show that caffeine actually causes a quicker, clearer flow of thought and permits more sustained intellectual effort. As its action creeps down the spinal cord, ease of muscular action increases and we are less easily fatigued. Heart muscle is even affected and the beat is speeded. Hitting the vasomotor nerves, caffeine causes the blood vessels to

dilate. This, together with the heart action, increases blood flow. Indirectly this speeds elimination of kidney secretions. These actions are antagonistic to alcohol and explain why inebriates like a nightcap of coffee.

All in all, coffee has earned its reputation as the American "pick-me-up." And science has now pretty well exploded the theory that moderate use of coffee is harmful in any way to the average normal person. Kola, ingredient of many soft drinks, also owes its stimulating properties to caffeine. It comes from the Gooroo nuts of trees in far-off Africa and the West Indies.

The change to hot chocolate, planned by many, will not have the same action as coffee and tea. The active ingredient, theobromine, has little central stimulation or effect on the brain, but has an even more powerful effect on blood flow and muscle. There is a relatively small dose in a cup of chocolate, however, and the quantity consumed is not likely to be as great.

Although the African Gold Coast has sent us about 60 per cent. of the supply of chocolate-laden seeds from cacao trees, it is also being successfully grown in Central America and Mexico. Natives break open the big red melon-like fruits, remove the seeds and place them in the ground. After a fermentation process, the seeds are roasted and the inner seeds ground into chocolate.—GLENN SONNEDECKER.

THE MEDICAL DEPARTMENT OF THE ARMY

THE Army's medical department "is now operating an enormous and far-flung chain of hospitals half girdling the globe," was reported by Major General James C. Magee, the Surgeon General, to the San Antonio meeting of the Association of Military Surgeons of the United States.

Medical supply installations have kept pace with the hospitals, and both the hospital facilities and supply service have functioned without serious difficulty throughout the trying period of Army expansion and war. The weight of medical supplies has been shifted to St. Louis, and the medical depot there is now the largest depot of any army or service of the Army.

The efficiency of the system of the department for sorting and evacuating wounded showed up in the brilliant results after the Pearl Harbor disaster. The sulfa drugs and blood plasma banks got much of the credit for the medical victory there, but General Magee pointed out that without the efficient sorting and evacuation system, which functioned from the earliest phases of the attack, "neither sulfanilamide, plasma, nor surgical skill could have availed to save the lives of the wounded." The newest aids to rapid and efficient evacuation of the wounded with which the Army is experimenting are autogiros and jeeps.

Significant advances in disease prevention during the past twelve months were universal vaccination against tetanus and extension of vaccination against yellow fever to include all military personnel of the first mobilization objective. The jaundice which followed some of these vaccinations was proved definitely not to be yellow fever. He reported that admissions for jaundice associated with vaccinations have now ceased. The type of vaccine has

been changed and vaccinations are given now only to those expected to serve in yellow fever regions. Immunization against bubonic plague, cholera and typhus is being given troops expected to serve where those diseases are endemic.

General Magee paid high tribute to the courage of doctors, nurses and other medical personnel serving at Bataan. He told of one feat in particular, that of Colonel William D. North, "who returned to Fort Stotsenberg after that station had fallen to and was occupied by the Japanese, in order to replenish his store of medical supplies and secure a much-needed sterilizer unit from the station hospital. By what means he accomplished his self-appointed task with the help of a few of his native soldiers and what their experiences were, is a story shrouded in silence.

DEATHS FROM TUBERCULOSIS

AUTHENTIC figures showing increases in deaths from tuberculosis since the war in Paris, England, Wales, Scotland and Canada have been obtained by the National Tuberculosis Association.

Deaths from tuberculosis in Paris during the first six months of 1941 increased 10 per cent. over the deaths in the first half of 1939, and deaths among children from one to nine years increased 28 per cent. This increase is "doubly significant" because the city's population, as shown by the number of food ration cards, decreased by 14 per cent. Requests for sputum examinations in Paris laboratories increased greatly. The average number of positive results, that is, a result showing presence of tuberculosis germs in the sputum, increased from 59.1 per 100,000 examinations in 1939 to 211 per 100,000 in 1941.

The United States is the only nation so far unaffected by a war increase in tuberculosis, so far as authentic reports show. The 1941 rate was 44.4 cases per 100,000 population, a decline from the 45.9 per 100,000 figure of 1940, and preliminary data for 1942 indicate a continued slight decline in the TB death rate for our first year of war.

"Unconfirmed, but repeated, press reports emphasize a pronounced recent increase in the incidence of tuberculosis, diphtheria and scarlet fever in Germany," is stated in its current *Bulletin* of the association. "Detailed reports signed by accredited physicians or statisticians covering vital statistics in Germany for the past year or two are not available." Alarming increases in the disease have also been reported from China, Greece, the Low Occupied Countries and Poland, but no authoritative figures are available. No significant reports on tuberculosis from Russia, Italy or Finland could be found by the association's statistical service.

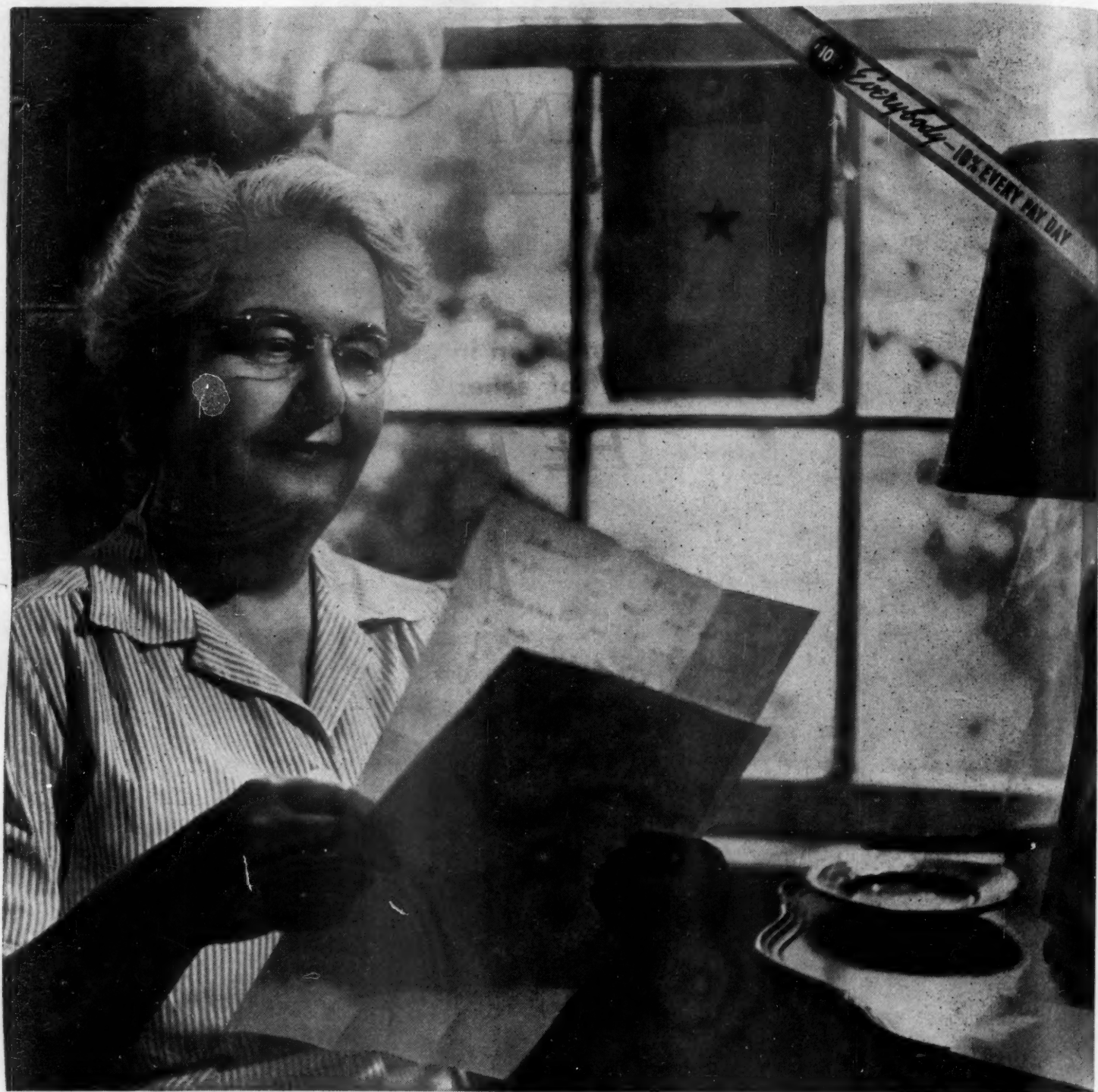
Between 1939-1941 deaths from tuberculosis in England and Wales increased 10 per cent. In Scotland the increase was even higher, 18 per cent. Canada reports an increase in the tuberculosis death rate in 1941 of 5 per cent. over the 1940 rate, adding that this is the first appreciable increase in the disease in that country in fifteen years.

ITEMS

AFTER the war the numbers of men and women in the country will be practically equal is suggested by a report from Metropolitan Life Insurance Company statisticians. The peak sex ratio of 1,060 males to every 1,000 females was reached in 1910, following a decade of the "greatest voluntary movement of population the world has probably ever seen." Since then the ratio of men to women has been steadily dropping. In 1940 it was 1,007 males to every 1,000 females. Since then (1940), there have been important changes arising from the war conditions. Many areas have suffered a loss of population to newly expanding industrial centers. All areas have undergone a withdrawal of men for military service. The outlook is that our post-war society may be constituted of practically equal numbers of men and women, and without such marked variations in different parts of the country as were found in the past.

SEARCH for the reason why draft boards are having to turn down more men for bad teeth in New England, heart trouble in the Northwest, goiter in the Great Lakes region and blindness in Texas, will soon be started at Columbia University, under the direction of Dr. Harry L. Shapiro, anthropologist of the American Museum of Natural History. He is of the opinion that the geographical distribution of characteristic physical defects is partly due to heredity, partly to social or local geographic conditions, and partly to a mixture of the two. The fact that mental disorders are found most frequently in Maine, Virginia, the Carolinas, Tennessee and Mississippi, and the high incidence of venereal disease, drug addiction and alcoholism in the Gulf States and the Southeast is probably due to environment. But the deafness found in the Northwest and New England and the lack of weight characteristic of the east coast and of California may be hereditary.

GRAPES grew in what is now the western United States in the Miocene times, long before there were any human beings, and the only creatures who might have appreciated them were animals like humpless camels, long-tusked mastodons and giant hogs. Evidence of their existence then is supplied by a bit of petrified grapevine found in western Nevada. It is the first fossil of its kind to be found in this country, though fossil grape leaf imprints have previously been reported. The piece of fossil vine is about 2½ inches long and a little over half an inch in diameter. It has the bases of two stout tendrils wrapped around it, and its internal structure has been so well preserved that the pores in the wood and the pith-rays are plainly visible. The specimen, which was sent to the National Museum by Mark M. Foster, of Denio, Ore., has been studied by Dr. Roland W. Brown, of the U. S. Geological Survey. In the *Journal* of the Washington Academy of Sciences it is given the scientific name, *Vitoxylon opalinum*.



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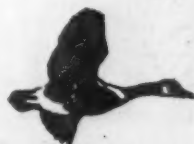
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SCIENCE NEWS

Science Service, Washington, D. C.

DISCOVERY OF NOVA PUPPIS

A NEW star or nova brighter than all but ten stars in all the heavens has burst forth and may be seen in the early morning sky. It is somewhat brighter than first magnitude. This is the brightest nova since 1918 and is the most striking and unexpected of astronomical events.

Discovered by an American astronomer in Argentina, the brilliant new star will be known as Nova Puppis, because it is located in the constellation of Puppis, meaning the stern of the ship.

It may become known as this year's Christmas star because one of the explanations of the star of Bethlehem is that it was such a nova.

The new star was discovered the past week end by Bernhard H. Dawson, of the University Observatory at La Plata, Argentina. He is an American astronomer, born and educated in Michigan. News of the discovery was received at Harvard Observatory in the form of a brief telegram signed by Enrique Gaviola, director of the Argentine National Observatory at Cordoba, Argentina.

The constellation Puppis, in which the nova is located, is in the southern sky, rising about 2:00 A.M. during November and crossing the meridian about 5:00 in the morning. The nova is situated near the second magnitude star Zeta Puppis, sometimes called Naos.

But the nova, according to Leon Campbell, recorder of the American Association of Variable Star Observers, outshines all stars in its vicinity, for on the morning of Armistice Day it was of magnitude -0.8 (minus zero point eight) which makes it brighter at present than the star Altair in the eagle.

Those who can find Sirius can easily find the new star. Sirius, brightest star in the sky, rises after midnight in the southeast. An hour and a half later Nova Puppis rises, but much farther to the south. Sirius is in Canis Major, the constellation of the big dog, the southern part of which is a triangle of three second magnitude stars. A line from Sirius through the triangle prolonged about its own length will end near the nova.

Not since 1918 has a star of the first magnitude blazed forth. In that year it was during the eclipse of the sun in June that a nova was discovered in the daytime sky.

The nova now in the skies may remain at its peak brightness for several weeks, or it may decline rapidly. Its behavior can not be predicted exactly. Meanwhile, it alters the appearance of the sky in its vicinity greatly.

Only 20 stars in the whole sky are of the first magnitude. Thus, this star takes its place among the first 20; in fact, it is now the eleventh brightest star in the entire sky and the seventh brightest to be seen from Washington's latitude. It may even get brighter, but usually novae are not seen much before their maximum brightness.

Astronomers will check the position of the nova with those of stars on earlier photographs of the same region to determine which of the faint stars in this part of the milky way suddenly flared up so bright. Novae are not really new at all, but old stars which suddenly increase in brightness hundreds of thousands of times.

Nova Cygni, reported earlier by Science Service this year, reached only the eighth magnitude. Nova Puppis is about six hundred times as bright as this was, and Nova Cygni has now faded to the 15th magnitude.

The first glimpse of Nova Puppis was obtained by Dr. Edison Pettit, of the Mount Wilson Observatory, on the morning of November 10. This was an independent discovery of the nova, first report of which came from Argentina.

Dr. Pettit, who specializes in observations of the sun and not the stars, sighted the nova by accident and not during the course of regular astronomical work. He immediately checked its position with a 6-inch telescope in his backyard observatory. A photometer happened to be attached to the instrument so that he was able to make an accurate measurement of the nova's brightness. It was then about as bright as Rigel, the brightest in the constellation of Orion, just north of the nova.

The star was seen too late to photograph at the observatory on Mount Wilson that morning, but preparations were made during the day and many photographs of the spectrum of the nova were taken at the 100-inch telescope the following morning. The nova is too far south to observe with the 60-inch telescope on Mount Wilson.

On the morning of Thursday, November 12, astronomers estimated the nova was still of the first magnitude.

SPECTRUM OF NOVA PUPPIS

NOVA PUPPIS is now in the midst of its most violent phase of ejection of gas, is indicated by observations of its spectrum by Dr. A. D. Maxwell and Dr. Dean B. McLaughlin, of the University of Michigan Observatory. This may mean that the brilliant star will become even brighter before it begins a decline in light which will finally return it to stellar oblivion. Already it is surpassed by only ten stars in the whole sky.

The Michigan spectra show strong interstellar calcium lines and allow estimates that the distance of the nova is such that it took light 1,600 years (traveling 186,000 miles per second) to reach earth and that the actual brilliance of the star is 150,000 times that of our sun.

Dr. Maxwell discovered the new star independently on Armistice Day morning before news of its discovery in Argentina had been received. It was then too late to take photographs of its spectrum. The next morning Drs. Maxwell and McLaughlin took successful spectrographs despite the difficulty of observations because the star is low in the southern sky.

The star's spectrum shows strong hazy bright hydrogen bands, conspicuous bright ionized iron and a neutral oxygen band at 6155, with their centers undisplaced. These are bordered on the edges of shorter wavelength by diffuse absorption lines. Absorptions of ionized titanium, magnesium and silicon are also present. No traces are seen of helium or other "hot star" lines. Displacements of absorption lines are discordant. Hydrogen is shifted the equivalent of a motion of 1,100 kilometers (700 miles) per second toward the earth, iron and titanium about 900

kilometers (550 miles) per second and magnesium somewhat less.

THE SUPPLY OF PHYSICIANS

"BUSINESS as usual" is out for the private physician and the health officer just as it is for industrial concerns and small manufacturers and dealers, according to a statement made by Dr. Thomas Parran, Surgeon General of the U. S. Public Health Service, at the Richmond meeting of the Southern Medical Association.

Even if available medical services are rationed under National Service legislation, as has been proposed and discussed in recent weeks, great efforts must be made to increase the supply of personnel. This means keeping enough physicians in medical schools to teach and train more students. Medical students and, if the draft age is lowered, premedical students could, he suggested, be enrolled as a special category of professional manpower and, upon completion of internship, allocated among the Army, Navy and civilian services.

"This," he said, "would eliminate the present uneconomical procedure under which the Army and the Navy compete for medical students by commissioning them in numbers which may later prove disproportionate to the needs of the respective services. Much depends now and more will depend after the war upon a continuing flow of young, able-bodied physicians of the highest caliber."

The Medical and Health Committee has recently approved a plan for increasing the number of graduate nurses and meeting the growing deficiency in hospital nursing services. The plan calls for speeding up the basic training course for completion in twenty-four months, after which third-year students would go on the payroll of the parent hospital or affiliated institutions. They would live outside the hospital, thus leaving dormitory and classroom space for more students. They would not receive their certificates until after three years of training, but their release in the last year would supply civilian hospitals with replacements for the general duty nurses who have been drawn into war service. The physical facilities for nurse training would be increased by a third and hospitals would be provided with an augmented staff for war duty.

The difficult task of supplying medical services in critical areas now lacking them can best be handled one by one. Following this thought, plans for meeting needs in different communities will be worked out individually. Such plans are now being made by the Procurement and Assignment Service and the Public Health Service.

INVENTIONS OF WORKERS IN THE U. S. DEPARTMENT OF AGRICULTURE

SUGAR from sorghum, fireproofing, better insecticides and over 50 other inventions have been developed by workers in the U. S. Department of Agriculture in the past year. Most of the devices were developed to increase farm efficiency, officials stated, but many will have direct importance to every one in meeting wartime needs.

Sugar yield from sorghum comparable with that ob-

tained from sugar cane, for example, will now be possible for the first time. The process was patented by Emil K. Ventre and Howard B. Paine, of the Agricultural Research Administration.

Establishment of an industry to relieve the sugar shortage will result, it is hoped, from research to develop improved sorghum varieties. Some varieties of high sugar content mature early enough, it is pointed out, so that sugar factories could process the sorghum before the sugar-cane harvest, using the same equipment.

An improved insecticide has been developed by Samson R. Dutky, of the Agricultural Research Administration, for combatting the Japanese beetle, a destructive insect in many areas. The new insecticide consists of an inert powder mixed with large numbers of germ spores which produce a milky disease fatal to the larvae.

A trap for moths of the tobacco and tomato worms, developed by Lincoln B. Scott and Joe Milam, of the Bureau of Entomology and Plant Quarantine, is another device for insect control.

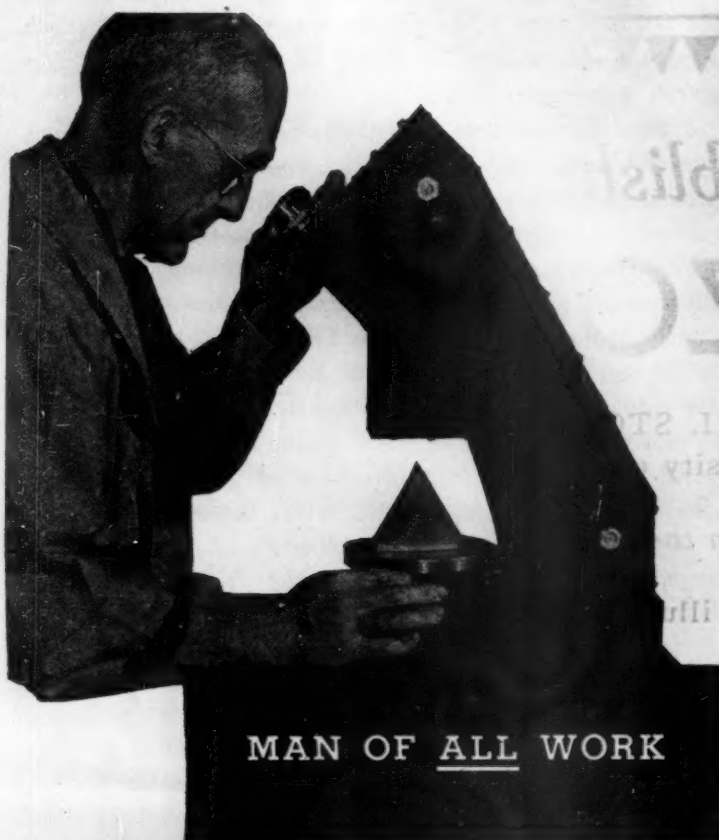
A method for checking the development of rancidity in oils and fats, a process which increases the resistance of nails to withdrawal from wood, and a chemical preparation for fireproofing fabrics are covered by other patents.

Of the inventions listed by the Department of Agriculture, about half were dedicated to the public and the remainder were assigned to concerns for development, with control retained by the department.

ITEMS

VISITORS to the American Museum of Natural History can get a glimpse of what life on Guadalcanal was like in more peaceful times, in a new habitat group showing typical birds of that remote but now familiar island. The exhibit is one of four showing birds and their homes in South Pacific islands, collected by a scientific expedition four years ago, under the leadership of the late Lieutenant A. B. Fahnestock and his brother, Captain J. S. Fahnestock. Among the strangest of the birds shown are the brush fowl, which buries its eggs in a mass of fermenting dead leaves which act as a natural incubator; and the dwarf climbing parrot, a little bird no bigger than a sparrow, that climbs trees like a woodpecker and makes its home in the nest of termites which appear to be its principal food.

ROTENONE, needed in our unending defense against insects, is an essential ingredient in fly sprays and other insecticides. It is extracted from the roots of certain tropical plants of the bean family, that grow both in southeast Asia and in the Amazon basin of South America. Before the war, we used to get a large part of our requirements from Malaya and the East Indies, the rest from South America. Now the two South American nations are coming to the rescue by greatly increasing their exports. The rotenone-bearing roots will be supplied through regular trade channels and the Commodity Credit Corporation will act as sole purchaser for the United States, paying agreed-on prices.



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SCIENCE NEWS

Science Service, Washington, D. C.

A PLANET OUTSIDE OUR SOLAR SYSTEM

THE first evidence ever produced for the existence of any planet among the billions of suns that swarm outside our own little solar system was presented at Philadelphia before the meeting of the American Philosophical Society by K. Aa. Strand, research associate at the Sproul Observatory of Swarthmore College. No one has ever seen the planet. Probably no one ever will. Like many other things of whose existence we are fairly well assured, this extra-solar-system planet manifests its presence by what it does.

Mr. Strand was making a study of a comparatively obscure double star in Cygnus, the Swan or Northern Cross. As with all objects of its class, the two stars that form the double one circle around and around each other in an eternal dance. But Mr. Strand noticed on the many photographic plates he examined that the orbits of the two stars were not exactly smooth. Something caused irregularities in the star paths—perturbations, astronomers call them.

The only thing that could explain the irregularities was the presence of a third object, close enough and massive enough to drag one or both slightly out of orbit by gravitational pull. Calculations indicated that this must be an object far smaller than any known star—only one sixtieth the mass of the sun, which is one of the smaller stars. This gives it a mass about sixteen times that of Jupiter in our own system. It swings around the star that is its sun once every 4.9 years, and has a decidedly lopsided orbit, contrasting strongly with the nearly circular paths of the planets of our own system.

NOVA PUPPIS

ASTRONOMERS at the Harvard Observatory searching their longest exposure photographs taken through their largest telescopes are unable to find any star that existed in past years where Nova Puppis flashed forth in the sky. This means that the star increased in brilliance at least 6,000,000 times, a rise of 17 magnitudes at least, because it must have been fainter than the 18th magnitude that can be detected by stellar photography.

Miss Constance D. Boyd and Dr. Fred L. Whipple made preliminary measures of plates going to the 16th magnitude, and found no star present where the nova is located.

And even on three-hour exposure plates taken with the Bruce 24-inch camera at Harvard's southern station at Bloemfontein, South Africa, which goes nearly to the 18th magnitude, they fail to find a trace of the star.

The great increase in brilliance almost puts the star in the ranks of the supernovae, which are usually observed only in the far spiral nebulae. These are galaxies like our own Milky Way, but they are very numerous. Consequently, supernovae are fairly frequent, but only about every 300 or 500 years does one appear in a galaxy. However, further studies of magnitude changes and spectrum must be made before the character of this latest nova can be ascertained.

Meanwhile, Nova Puppis is fading rapidly, nearly a magnitude every 24 hours. It reached its peak on November 12. Amateur astronomers, particularly members of the American Association of Variable Star Observers, are being urged to watch it regularly, to see if it suddenly increases its light again. Fluctuations may be expected.

Spectra of the nova are being taken at all the large observatories. Such spectra show the rapid changes which are taking place in the condition of the star following its maximum light. There is indication that a shell of gas may be expanding around the star at a speed of possibly 1,000 kilometers per second. The star's distance also seems to be very great, probably on the order of several thousand light years. This is more or less confirmed by the extreme faintness before its outburst.

COLOR VISION

OBSERVERS with weak color vision do have an advantage in detecting faulty camouflage, was pointed out by Dr. Deane B. Judd, of the National Bureau of Standards, at a recent meeting of the Washington Academy of Sciences.

Men who are completely colorblind or even partially colorblind do not have this advantage. Since, out of every 20 men, about one man has weak color vision and another is colorblind, the Army probably already has a good share of men capable of spotting the enemy's blunders in camouflage.

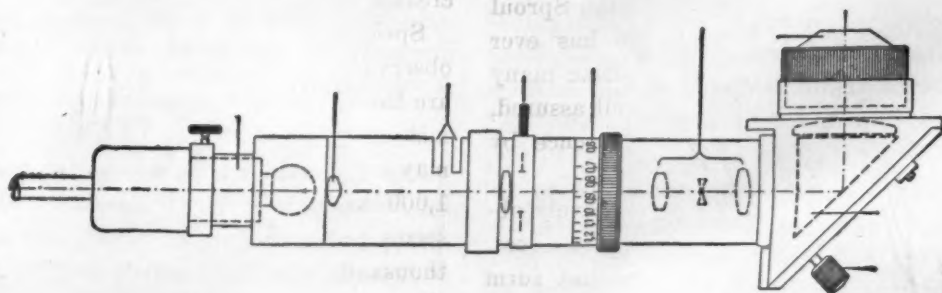
The most common form of colorblindness is the inability to distinguish red from green. Men with this color vision defect find it difficult to pick out ripe strawberries from green or to pick a rotten apple from a barrel of red apples. Since the vision of such persons for blue and yellow is normal, they are said to be only partially colorblind. To hide a military position from such a person it would be necessary to see that it was no lighter and no darker than the surrounding country. And it must be no bluer and no yellower.

But the partially colorblind person would not notice if the position happened to be a little redder or a little greener than objects around it, or if it were lacking in those colors.

The partially colorblind person, therefore, usually has no advantage over the man with normal color vision in detecting camouflage. If a roof or a gun-shield is painted so that the normal eye can not tell it from the ground or the foliage, the partially colorblind person can not distinguish it either.

Since nature provides the best camouflage, the Army usually prefers to use actual vegetation or dirt whenever possible to hide positions. But cut branches change color when they dry out and the leaves wilt. Dirt used in this way may dry out more rapidly after a rainstorm than the dirt on the ground. This produces slight differences in color and results in imperfect camouflage. Another fault in camouflage is in paint intended to match the surroundings. Such paint, even when it is a close match,

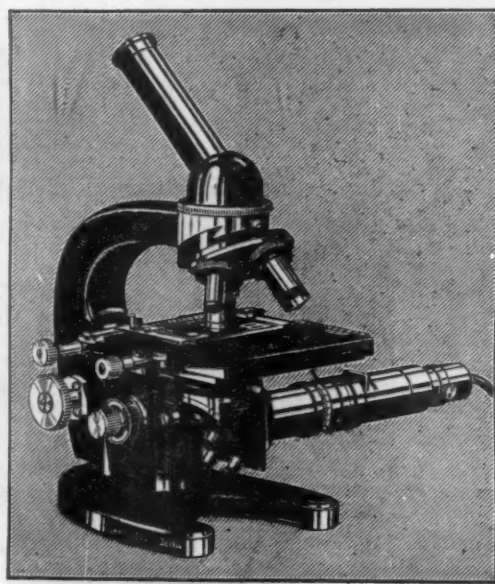
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is likely to differ in reflectances in some portions of the spectrum. It is such imperfections, not noticeable to the normal eye, that are picked up by the man who has weak color vision.

There are a few situations in which the red-green color-blind man has an advantage in detecting camouflage. In a variegated pattern made up of patches of reddish brown earth and yellowish green foliage, areas that are a little too light or too bluish are lost to the normal eye because of the larger red-green differences in the scene. But the colorblind observer doesn't see a variegated pattern of irregular red and green splotches. To him, there is a nearly uniform yellowish-brown field. A spot that is too light or too bluish would show up conspicuously to his eyes.

The normal individual can not make use of filters to fake weak color vision in order to detect camouflage. In order to screen out red and green, a filter would also screen out most of the light and make it very difficult to see anything. And the filter would not accurately duplicate the color vision of the partially colorblind person at that.—MARJORIE VAN DE WATER.

USE OF THROMBIN TO STOP BLEEDING

THROMBIN, natural clotting agent of the blood which is formed when blood is shed, is being widely used in the U.S.S.R. as a means of stopping dangerous bleeding from war wounds and is credited with saving the lives of many wounded men.

In 1941, after long research in the laboratories of Moscow University, I discovered a method of obtaining large quantities of sterilized, dissolved thrombin. When mixed with blood this solution will clot it within three to five seconds. Experiments on laboratory animals with this preparation confirmed the theoretical assumptions. Parenchymatic bleeding from injured liver, spleen or kidneys rapidly ceased after the wound was irrigated with thrombin solution. The preparation was then tested in surgical clinics and hospitals with good results, after which it began to be manufactured in large quantities for use in hospitals and dressing stations at the front.

Several soldiers with head wounds were brought to the neurosurgical clinic. In the case of two of them, shell splinters had penetrated deep into the brain and their removal was fraught with great danger, as they had lodged in the immediate vicinity of blood-carrying sinuses of the brain. The surgeon nevertheless decided to operate. When the splinters were removed, blood began to gush profusely from the sinuses, but in both cases swabs steeped in thrombin and inserted into the apertures of the wounds quickly stopped the blood flow. When the swabs were removed bleeding was not resumed and recovery proceeded rapidly. One of the men had his skull shattered in the region of the temple and part of the brain protruded in the form of a large blood-filled swelling. Cutting the swelling would have caused profuse bleeding. The surgeon injected a small quantity of thrombin with a syringe. The protruding part of brain was then opened and the blood removed in the form of a clot. There was no further bleeding and the operation was quite dry.

In the short period thrombin has been in use there have been numerous instances of this kind. It has proved a valuable means not only of saving blood but also lives of wounded men. The effect of this blood-stopping preparation in no way differs from natural blood clotting. When applied locally thrombin merely accelerates blood clotting—ten and in some cases even one hundred times without, moreover, deleterious effects on the wound or on the patient. It is absolutely harmless.

Production of thrombin has now been placed on solid industrial lines on a scale fully adequate to meet the demands of the front.—Cable from Russia by BORIS KUDRYASHOV.

ITEMS

FOR the second time within the year, a Finnish woman astronomer, Miss L. Oterma of Turku Observatory, has discovered a new comet. This one is in the constellation of Taurus, the Bull, and it is 13th magnitude, much too faint to be seen without telescopic aid. The new comet is near the celestial equator and moving northward. It is not far from the famous star cluster, the Hyades, shaped like a V, which rises in the eastern sky early these autumn evenings. More observations and considerable mathematical computations will be necessary before it is determined whether the new comet will become brighter.

A NEW test that tells more exactly the spot for operation on the back in cases of sciatica and low back pain is reported by Dr. Walter E. Dandy, of the Johns Hopkins Hospital, in the forthcoming issue of the *Journal of the American Medical Association*. In almost all cases of sciatica with low backache, the trouble is due to rupture or defect of an intervertebral disk, the layer of fibrocartilage between the bodies of the vertebrae. Treatment by operation is "absolutely safe and a cure is practically assured." The diagnosis, he believes, can be made solely on the patient's story of attacks of sciatica and low backache occurring after a relatively trivial injury, such as a lift, bend or strain, with the pain made worse during attacks by coughing or sneezing. In almost all cases the affected disks are at the fourth or fifth lumbar vertebra.

ANNOUNCEMENT that the National Foundation for Infantile Paralysis had 100 per cent. wool available for patients getting the Kenny treatment resulted in a deluge of requests to headquarters. Consequently the foundation now announces that the wool can only be shipped to hospitals where the need is immediate, that is, where patients in the early stages of infantile paralysis are actually under treatment when the request is made. The material, available through the cooperation of the National Paperboard Association, can not be shipped in anticipation of cases that may occur in the future. In communities where there are only one or two cases, it is suggested that sufficient material, such as old blankets, lightweight woolen suiting and the like, can be obtained without calling on the supplies of the foundation. An average of five pounds of woolen material is required for each patient. Those requesting it from the foundation are asked to order only as much as is needed.

RECENT PUBLICATIONS CARNEGIE INSTITUTION OF WASHINGTON WASHINGTON, D. C.

Pub. No.

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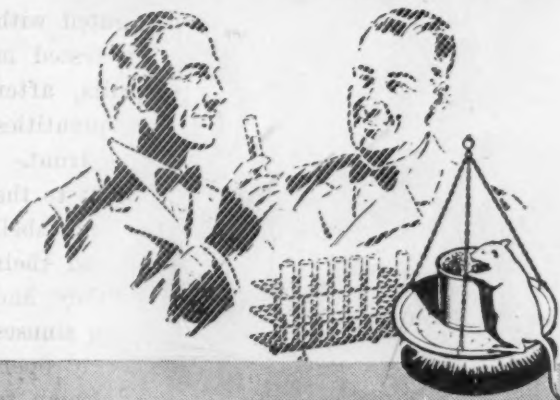
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SCIENCE NEWS

Science Service, Washington, D. C.

THE BETATRON

THAT the new atom-smashing Betatron, the most powerful X-ray in the world, may become a first-rank medical weapon for destroying malignant growths within the body, was reported by Professor Donald W. Kerst, who developed the instrument at the University of Illinois, to the Radiological Society of North America meeting in Chicago.

Mankind's most dreaded disease enemy might be attacked by this new weapon in either of two ways: first, by use of its 20-million-volt X-rays, and, second, by using directly the electron beam which makes the X-rays.

The new machine is not yet ready for use in treating patients and no tests with it have as yet been made on living tissues. Dr. Kerst and his assistants, Philip Morrison and H. W. Koch, have, however, measured the penetration of the X-rays and electron beams through material equivalent in absorbing power to tissues. These tests show that, unlike the 400,000 volt X-ray machines now used to attack malignant growths, the rays from the Betatron would produce their maximum effect about one and a half inches below the surface of the body instead of at the surface. This means that the killing rays would have little effect on the skin and fat beneath it, but would deliver their full effect on growths within the body. Sending the electrons directly into the patient is the most promising way to use the Betatron treatment. At 20 million volts these electrons will penetrate as far as 10 centimeters (about four inches) and no farther. Thus there is no damage beyond the area of treatment.

The Betatron is a compact machine and relatively inexpensive for the voltage produced. It is about the size of an office desk, and has a control panel and condenser bank, each of about the same office desk size, and a motor generator. It is thus smaller than many X-ray machines of considerably less voltage now in use and requires about the same amount of power for operation.

NEW COLOR STANDARDS

FOLLOWING the Victory bicycle and the Victory typewriter, one of the newest subjects of standardization is color itself.

The new war standards to specify and describe color were explained to the press at a conference of the American Standards Association by Dr. Deane B. Judd, physicist of the National Bureau of Standards; Arthur C. Hardy, of the Massachusetts Institute of Technology, and Dr. Lloyd Jones, of the Eastman Kodak Company.

While research technicians have been measuring color by means of spectrophotometers for almost half a century, said Dr. Judd, there was no public agreement on how colors should be described. The shade known to colorimetrists as "9YR 7.2/4.5," for instance, might be called orange by the housewife, apricot by the dress manufacturer, yellow by the paint industry, and red by the druggist.

The new standards adopted in June include a system

for designating 319 colors with consistent names, based on the Munsell Color Standard. According to this system, worked out by Dr. Judd and Kenneth L. Kelly at the National Bureau of Standards, "9YR 7.2/4.5" will henceforth be called "weak orange" for practical purposes, since it falls within that range. While theoretically the human eye can distinguish about ten million different colors, 319 names are ample for everyday purposes. But for specifying color, or when a more precise description is required, technicians will continue to use numbers.

This standardization of easily understood names such as reddish brown, olive brown, olive green, etc., was originally undertaken to meet the needs of drug chemists and pharmacists. But now that it has been adopted as a part of the American War Standards for color it will be a boon to practically all industrialists and merchants, including of course the ultimate consumer. Adopted by the Textile Color Card Association, the term "pinkish grey" will mean more to clothing buyers and wholesalers than "Algerian sand." However, consumers will doubtless continue to buy Algerian sands and Morocco scarlets, since the new specifications make it clear that they are not intended to replace names used in sales promotion.

The new standards coordinate these four principles of color specification and description: (1) The spectrophotometer shall be recognized as the basic instrument of color standardization. (2) Specifications shall be derived from the color system adopted in 1931 by the International Commission on Illumination. (3) For the popular identification of color, material standards shall be used according to the Munsell system. (4) A descriptive name, derived from the Munsell notation, is recommended wherever general comprehensibility is desired and precision is not important.

SULFA DRUG FILM FOR SURGICAL DRESSING ON BURNS

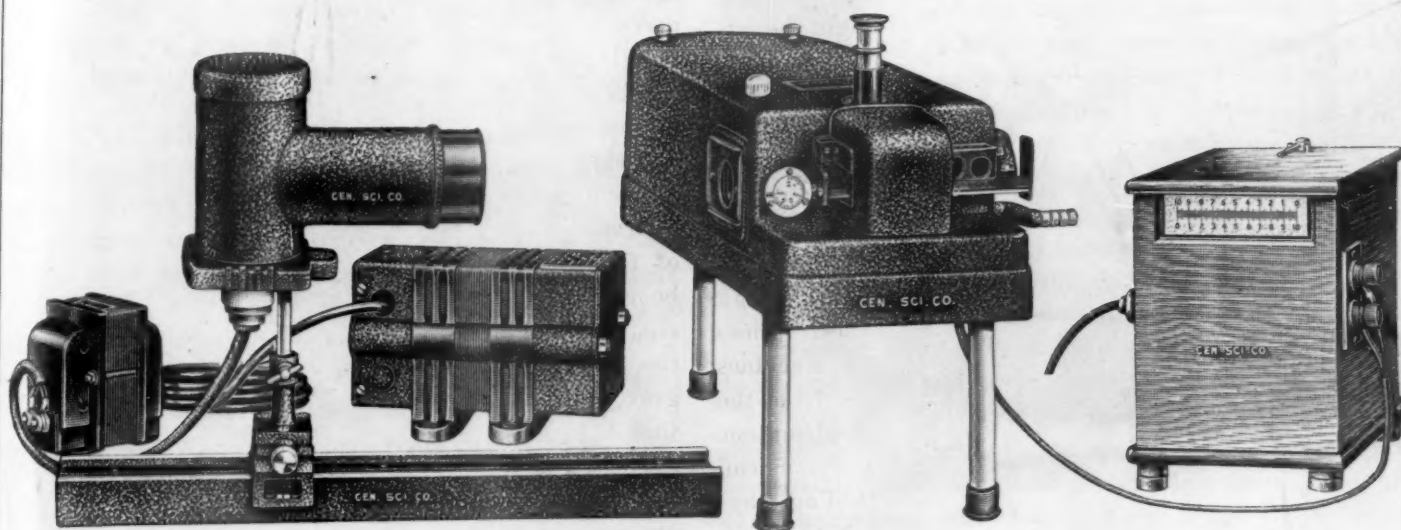
A NEW kind of surgical dressing for burns and wounds, expected to be of use to our armed forces, has been developed by Dr. Kenneth L. Pickrell, of the department of surgery of the Johns Hopkins University and Hospital.

It is a film which looks something like rough waxed paper but which carries a powerful wallop against germs in its 30 per cent. to 50 per cent. content of sulfadiazine. Dr. Pickrell reports in the *Bulletin* of the Johns Hopkins Hospital that these sulfa drug films have been used in more than 100 cases, about 50 of which were patients with burns. In 30 of the burned patients, bacteriological studies showed no evidence of infection. In the other cases bacteriological studies were not made, but no signs of infections were seen on inspection of the wounds and burned areas.

When used on burns, the burned surface and surrounding skin, should there be gross contamination, is first cleaned with a surgical detergent. The area is then

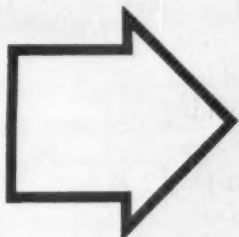
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washed with salt solution, sulfadiazine or azochloramid solution and while the area is still wet the sulfa drug film is put on, over which a smooth, firm pressure dressing of gauze is applied. The sulfa film is left in place for three to five days, at the end of which time, in second degree burns, new skin will be forming. In third degree burns and in wounds or sores with discharge, the film may be renewed as desired. Since it is translucent, the surgeon can inspect the wound or burn without removing the film.

The sulfa film is made by preparing an emulsion of 3 per cent. sulfadiazine or 3 per cent. sulfanilamide, 2.5 per cent. methyl cellulose (this is one of the newer plastics materials), 3 per cent. triethanolamine and 0.5 per cent. sorbitol with 50 per cent. alcohol or acetone to make 100 cubic centimeters (about three ounces). This is sprayed on a smooth, horizontal glass surface with a pressure gun or paint spray apparatus and allowed to dry, after which it is removed in a single sheet.

The sheets can be made any size, but at the Johns Hopkins they are cut in three-inch widths and rolled just like any bandage. They keep well and can be sterilized by dry heat. They are light in weight and can be packed easily in sheets, tablets or rolls.

Physicians who have seen them on visits to the hospital have been interested and enthusiastic about them and several of the larger commercial houses are beginning to prepare them. The films were developed following Dr. Pickrell's discovery that a solution of sulfadiazine in triethanolamine was effective in treatment of burns, the successful use of this solution in combating sinus infection, complications of the common cold, irrigating infected wounds and sinuses, preparing the surgical site for operations around or in the eyes and various body openings, and for fighting infection in skin grafts. Certain disadvantages of this solution, such as slow drying time and the thinness and fragility of the film it formed, led to development of the stronger film with methyl cellulose.—JANE STAFFORD.

DECLINE IN NUMBERS OF CARS AND TRUCKS ON ROAD

GASOLINE rationing, tire shortage and wartime restrictions on travel in general have contributed to a very decided decline in road-borne traffic, according to John T. Lynch, highway engineer-economist of the Public Roads Administration, in a report to the Highway Research Board meeting in St. Louis. There has been a steady decline in number of vehicles of all classes, though the ratio of trucks to cars has risen. A higher percentage of trucks are running without loads, but trucks that do have loads are carrying bigger ones.

Mr. Lynch reported the results of a country-wide survey of country highway travel, in which more than 500,000 vehicles were counted and classified and more than 50,000 trucks were weighed at 486 stations.

Traffic declined steadily from February to August of this year, as compared with figures for the same months in 1941. The decline was checked in September. This was due in part, Mr. Lynch thinks, to the passing of the normal vacation season, which this year was a period of

very light traffic because of the large number of persons who did not travel by automobile.

The increased proportion of trucks running light may be traced partly to the use of light trucks as substitutes for buses and personal cars in getting workmen to their jobs, partly to the fact that many of the trucks were engaged in carrying materials to cantonments, airfields and other places where they had no chance to pick up return loads. The cargoes of trucks that did have loads were so much greater than they had been in pre-war times that despite the decreased number of loads the number of ton-miles of load carried by truck, for the country as a whole, is almost as great as in 1940. In the Pacific Coast region, indeed, it is 22 per cent. greater.

THE NICKEL-LESS "NICKEL"

THE new nickel-less nickel now in circulation contains 56 per cent. copper, 35 per cent. silver and 9 per cent. manganese, concluding a year-old research project of the Treasury, according to Mrs. Nellie Taylor Ross, director of the United States Mint.

Over a year ago, when the shortage of nickel first became acute, stainless steel was suggested as a replacement for 75 per cent. copper and 25 per cent. nickel in the old five-cent piece. Then came Pearl Harbor, greatly reducing our imports of chrome for stainless steel.

"So we tried silver and copper next," said Mrs. Ross. The trouble was that when this alloy was tested on slot machines, it was flatly rejected by certain types of vending machines, widely used for cigarettes and candy. The silver and copper were such good conductors of electricity that the principle of electrical resistance invariably bounced the experimental coin right into the rejection slot.

This problem was finally solved by adding manganese, and then Congress passed a bill authorizing the new coin. Manganese, being a poor conductor of electricity, reduced the conductivity of the copper-and-silver alloy to the approximate level of the old copper-and-nickel coin. But too much manganese made it too brittle to be rolled into the flat metal strips from which the coins are stamped. After further experimentation, it was found that 9 per cent. was the minimum amount of manganese required to operate all vending machines.

A new problem immediately arose, but not a serious one, Treasury spokesmen say. The old nickels were "cold rolled," that is, the molten metal was poured into long, thin, rectangular molds to form ingots, which were allowed to cool and harden, then pressed into flat strips. However, manganese made the ingots so hard that new annealing furnaces had to be installed in order to heat the ingots several times during the rolling process. Ingots for the new "nickels" are not remelted, but they must be heated to 1,200 degrees Fahrenheit to facilitate rolling.

The new five-cent piece is bright and shiny, resembling a new dime or quarter more than the old nickel. However, it tarnishes more quickly and turn a strange yellowish-gray color. If you're wondering whether you have one in your pocket, look at the Monticello design on the back. The new issue has the mint mark directly over

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the dome: "S" for San Francisco, "D" for Denver, or "P" for Philadelphia. This, by the way, is the first time the mark of the parent mint in Philadelphia has ever appeared on a coin. Adoption of the new coin is distinctly a war measure. The Act authorizing it expires on December 31, 1946, by which time it is hoped the war will be over.

THE PENNY

ANOTHER consumer commodity has become critically scarce, the penny. Yes, the humble bronze one-cent piece is a commodity like any other, manufactured to meet consumer demand. But the demand is growing faster than the supply, there are no reserve stocks, and no copper available to make new ones.

The Treasury is experimenting with substitute materials, the favored ones now being plastics or steel, coated with less than 1 per cent. of zinc to keep it from rusting. But steel, zinc and plastics are all scarce.

Meanwhile tons of critically vital copper lie hidden away in bureau drawers and baby's banks in millions of American homes. Last year four thousand tons of copper went into pennies. This is enough to meet the combined copper requirements of building 2 cruisers, 2 destroyers, 1245 Flying Fortresses, 120 field guns and 120 howitzers. If every American family could unearth just 40 pennies hidden away in banks and boxes, this would exactly equal last year's production, one and a half billion pennies, four thousand tons of copper.

"We must get those hidden pennies back into circulation," says Mrs. Nellie Tayloe Ross, director of the United States Mint. "If the people only realized the importance of this, I know that every penny bank in the country would immediately be converted into war stamps.

"For the past two years the Mint has been working 24 hours a day, including weekends," said Mrs. Ross, "to supply the coins which are essential to the economic life of the Nation. Last year's output of 1½ billion pennies was one tenth of the Mint's total penny production of the last 150 years."

And still the demand grows. War conditions have brought an unprecedented demand. Federal and State sales taxes consume pennies, so do rising prices. Many lunch counters now charge 6¢ for a cup of coffee or a piece of pie, many commodities are now priced at odd figures such as 32¢. Penny vending machines have increased. And of course the Nation's total volume of business has jumped tremendously.

Mrs. Ross, describing the Treasury's difficulties in finding a substitute material for the copper in pennies, concludes "Everything is scarce." The first suggestion was zinc, which was promptly put on the critical list. Plastics were investigated exhaustively, only to become too valuable for war needs. Steel, now being considered, is also scarce and the Treasury has not abandoned its earlier experiments with plastics.

There is no intention of producing half-cent pieces, as has often been suggested, Mrs. Ross said. This would only multiply the problem by two.

The only abundant supply of coins which the Treasury has in stock is the silver dollar. Does any one want to

save silver dollars instead of pennies? While the new "nickel" is now composed of 35 per cent. silver, the Treasury could not use any appreciable amount of silver in pennies without making them worth more than five cents.

ITEMS

THAT water running off flight strips during heavy rainstorms constitutes one of the major engineering problems connected with emergency aids to aviation was reported by Carl F. Izzard, Public Roads Administration engineer, at the meeting of the Highway Research Board. A "rain-making" device has been built for the experimental study of this problem. It consists of a set of pipes with sprinkler nozzles, capable of delivering a synthetic rainstorm of any desired violence over a measured area, together with arrangements to catch and measure the water that runs off the surface. It has been used on both paved and turf-covered flight strips, and the data which have been accumulated are now being analyzed as rapidly as possible. Results will be published in the near future.

MANY factors influence plants in their use of elements taken from the soil to produce nutritional value, was pointed out by Dr. L. A. Maynard, of the U. S. Department of Agriculture, at the National Industrial Chemical Conference. With the same kind of soil nutrients available, but different rainfalls, two crops of bread wheat will have entirely different protein contents. The amount of ascorbic acid, one of the most important of vitamins, in tomatoes is powerfully influenced by the number of hours of sunlight per day received by the plants. Light intensity, as well as length of daylight period, affects the vitamin content of certain fruits and vegetables. Much research on this subject yet remains to be done. Consideration needs to be given to yields of nutrients as well as to tons or bushels per acre, to nutritional quality as well as to market quality.

THOSE who eat in restaurants, even the best of them, are being deprived of about three fourths of the vitamins they should be getting from vegetables. Actual figures on vitamin losses from restaurant-cooked vegetables was reported by Dr. Robert S. Harris, of Massachusetts Institute of Technology, to the American Dietetic Association. Dr. Harris advised restaurant eaters to eat early and concentrate on raw vegetables. In his study, Dr. Harris selected a restaurant using superior cooking and serving techniques. In spite of this, the average loss of anti-scurvy vitamin C from vegetables during cooking was 45 per cent., and the loss of thiamin (vitamin B₁) averaged 35 per cent. The large loss was attributed both to the destruction by heat and to the fact that the cooking water in which the vitamins are soluble was discarded. During the time the vegetables were held on the steam table before serving there was a further vitamin loss of about 15 per cent. Only about a fourth of the original vitamin content of the vegetables actually reached the consumer. It is evident, Dr. Harris pointed out, that the customers who eat earlier and who eat more raw vegetables will be better fed.

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SCIENCE NEWS

*Science Service, Washington, D. C.***SOME PAPERS READ AT THE NEW YORK MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS**

INDUSTRIAL progress in America is usually attributed to our natural resources, but few people realize that Americans, more than any other people of the world, have been responsible for the epoch-making inventions of the century. This was pointed out by A. A. Potter, dean of engineering at Purdue University, at the New York meeting of the American Society of Mechanical Engineers. Vital, young Americans, initiative spurred by their individual democratic rights being placed above those of the state, have produced some of the greatest of these discoveries. Westinghouse invented the airbrake at 21, for example, McCormick the harvester at 22, and Howe the sewing machine at 27. McCormick with his reaper gave more impetus to mechanized agriculture than any person in any other country. Among pioneer American inventions in the field of communication have been telegraph, transatlantic cable, telephone and many features of the radio. From the invention of the Clermont by Fulton to the patent for the airplane by Wright, Americans have been major contributors to the field of transportation. Many manufacturing processes are also included among American achievements, such as welding, cracking gasoline, vulcanizing rubber and the manufacture of aluminum and plastics. Our patent system, which encourages and rewards creative talent, has been a major factor in the industrial progress of this country, Dean Potter declared.

Infra-red rays are now being used to dry textiles after dyeing and finishing processes, was reported by George Fisher, of the Infra-Red Ray Equipment Corporation. Bombarding fabrics with the rays produces great heat, although infra-red waves themselves are not hot. This property of the rays has been known for some time, but application in the textile industry has only recently been made. Use of infra-red rays produced by gas-heated incandescent refractories has passed the experimental stage. Quite a number of such installations are in industrial operation, performing with excellent results. Since the rays do not heat the surrounding air, the high-speed production of large amounts of heat energy occurs right at the spot where the heat is needed. Operation has proved to be very economical. Steam heat, formerly used, could not be controlled as well as the new method and as a result the fabric was sometimes excessively exposed to heat and baked. Atmospheric burners and other gas-flame units which have been in use wasted much heat to the surrounding air and had other features which prevented drying as efficiently as by the infra-red ray method.

Speeding trains of the future will be powered by diesel electric locomotives which will far surpass anything that we have yet seen, was predicted by B. S. Cain, of the locomotive engineering department of the General Electric Company. Design progress has not stopped despite

standardization required by the war. Instead, war research has produced power plants with greater power in less space with less weight and designed for mass production. When peace comes, locomotive builders are ready to adapt these developments to railroad use. Production for the duration is limited to existing standard sizes and types best suited to wartime needs and emphasis is placed on the most efficient use of the limited material available. Use of small diesel-electric locomotives in industrial service has increased tremendously. These high-speed 150 to 500 horsepower engines are not in as great demand for implements of war as the large low-speed machine.

A shooting stream of gas is used to drive the first gas-turbine locomotive, which was described by Paul R. Sidler, of New York, resident engineer of Brown, Boveri & Company, Ltd. Built for the Swiss Federal Railways, the new-type locomotive has not been tested as thoroughly as desired because of fuel shortage and war conditions. But enough road tests over various tracks have been made to demonstrate that the gas-turbine locomotive not only came up to expectations but surpassed them in some respects. For certain uses it shows marked advantages over the Diesel locomotive, but in general it is not yet a serious competitor. It should be particularly suitable for express service over long distances, in areas where water is scarce and where there is a considerable difference in the costs of Diesel oil as against ordinary fuel oil.

That the use of wood in America's planes is steadily advancing in both quantity and quality, was reported by Dr. Robert J. Nebesar, chief engineer of the Universal Moulded Products Corporation. Aircraft with wooden fuselages and other parts have been shown to withstand shock and vibration very satisfactorily. Both servicing and repairs are inexpensive and comparatively easy to take care of, these presenting no engineering problems. New durable synthetic glues and ensuing improvements in wood processing, such as molding, pressing and other techniques, has resulted in an ever-increasing replacement of war-scarce metals by wood in some types of planes.

THE CONSERVATION OF VITAL MATERIALS

MORE than ten million pounds of nickel, chromium and molybdenum will be saved next year in the production of medium tanks alone, through the research of the War Engineering Board of the Society of Automotive Engineers is reported in the *Journal* of the society.

Cooperation of industry and the military, through research sponsored by the board, is expected to produce other large savings. Materials conservation is now being incorporated in the designs and specifications of new army equipment. Use of low-grade metals is being expedited to release the better alloys for more critical uses.

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aluminum and cork, and utilizes suitable substitutes. Development of cold-starting aids for military motorized equipment is among the current projects. Sufficient progress has been made to supply the Army with satisfactory expedients for this winter. Plans under way expect to make American armed forces the world's best equipped for sub-zero operations.

Other research projects contemplate development of equipment for the American army and navy which will assure satisfactory service in any climate in the world, with both production and servicing using a minimum amount of materials.

An "interim" secondary butyl tire has been developed by a committee created by the board, which appears capable of 15,000 miles of service and satisfactory for synthetic recapping materials. Manufacturers are cooperating in laboratory and field tests with the idea of making the material available for use in 1943.

THE NATIONAL HEALTH

THE national health picture is "pretty good," according to reports of communicable diseases received weekly by the U. S. Public Health Service.

The death rate in large cities has increased some 12 per cent. or 13 per cent. in recent weeks, chiefly because of influenza and pneumonia. Death rates from these two diseases are higher than the three-year average established by the service for basis of comparison since the introduction of the sulfa drugs which have so greatly reduced deaths from pneumonia.

Cases of influenza reported by state health officers have also been increasing, from 1,596 for the week ending November 14 to 1,851 for the week ending November 28, latest on which figures are available. About 60 per cent. to 70 per cent. of the cases for the recent weeks were reported from Texas, South Carolina and Virginia. So far, however, no signs of an influenza epidemic have appeared.

Meningococcus meningitis cases have been running higher all this year than during any year since 1937. The total number of cases for the week ending November 28 were 89, an increase of 25 over the number reported for the previous week. The five-year median figure runs around 30 cases per week for the nation. Only 17 cases have been reported from the nine service commands of the Army. Although the total number of cases in the nation is higher than usual, it does not represent any particular outbreak.

The largest number of cases of endemic typhus fever will probably be reported this year to the Public Health Service. More than 3,300 cases have been recorded so far, most of them from Texas and Georgia. The federal health service has been receiving reports on this disease since about 1930. Endemic typhus fever in the United States is a mild disease, spread by the rat flea, and not to be confused with the highly fatal European typhus fever.

ITEMS

CONTROVERSY over whether atabrine, the anti-malarial just made official in this country, is identical and equal to the original product developed in Germany, has now been settled in favor of America's chemists. A report

issued by the National Research Council establishes the fact that the drug manufactured in this country is comparable in every respect with that produced in other countries, according to the *Journal of the American Medical Association*. Atabrine, chemically known as quinine, is now in mass production as a substitute for quinine using the process developed abroad. But chemists here have also found their way through the intricate steps of chemical synthesis which produce the bright yellow crystals used to combat malarial fever. Unpleasant side-actions sometimes accompany the administration of the drug led to the suspicion that there might be defects in the manufacturing process or impurities present. Doubts have been dispelled by investigations in leading institutions throughout the country which indicate that these minor difficulties are inherent in the atabrine itself, as occurs in many standard medicines.

NEW resins are replacing old zeolite minerals and greensands for special uses requiring softened water of excellent quality, such as in breweries, canneries and beverage manufacturers. Extended application of the resins to prevent spoilage of medicinal enzyme preparations, to purify drugs, and to recover vitally needed metals from industrial wastes, was predicted by Dr. Robert J. Meyers of the Resinous Products and Chemical Company Laboratories of Philadelphia, speaking at the Buffalo meeting of the Western New York Section of the American Chemical Society.

WITH two great bulbous projections above the middle ear region, one of the most singular mammalian skull fossils ever seen has been described at the Academy of Natural Sciences, Philadelphia, with a scientific name that means "strange skull": *Xenoeranium*. The name was bestowed by Dr. Edwin H. Colbert. The extinct creature, represented only by a skull and lower jawbone, lived in what is now Wyoming some 60,000,000 years ago, near the beginning of the Age of Mammals, in the period called Oligocene by geologists. It belonged to the class known as edentates, which includes modern armadillos and their relatives.

FOSSIL bones of a groundhog that slept too long one winter some scores of thousands of years ago in its burrow on a mountainside in New Mexico tell a story of cooler, moister climate in the Southwest while the North was buried under its mile-thick blanket of ice. The find, and the consequent climatic inferences, are reported in the *American Journal of Science* by Dr. Charles E. Stearns, of Tufts College. The bones were found in a dust pocket, under a long-inactive landslide on a mountainside north of Albuquerque, at an altitude of 5,900 feet. The lowest altitude at which marmots live in that area now is about 4,000 feet higher than that. It is not known whether the animals must have the cooler climate of that altitude; but that is not of vital importance, because the green food on which the animals depend does not grow the year round in the more arid conditions prevailing at lower levels in the Southwest. So the presence of marmot remains at the 5,900-foot altitude argues for a cooler, moister climate at the time they lived there.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE DEATH RATE

A HINT that the shortage of doctors is already affecting the national health picture may be found in the death rate for eighty-eight large cities. For the week ending December 5, the latest on which figures are available, this took a big jump, to 13.5 per 1,000, although there are no signs of epidemics.

The increase was largely due to the mortality from the Boston night club fire, but correcting for this gives a death rate for the large cities of 12.8 per 1,000. The rate for the corresponding week in 1941 was 11.9 per 1,000, and the three-year average for the first week in December is also 11.9 per 1,000.

The death rate of 13.5 per 1,000 for the 88 large cities comes from the Census Bureau, and is based on total number of deaths without regard to cause, age or other factors. The U. S. Public Health Service, however, gets weekly reports from 88 large cities on pneumonia and influenza deaths. These are not all the same cities as covered by the Census Bureau weekly report. Different cities are included in order to get a better geographic picture of the influenza-pneumonia situation. The death rate for influenza and pneumonia based on the reports from these cities is also running higher than the average for the past three years at this season.

Influenza cases reported by state health officers to the U. S. Public Health Service increased somewhat during the week ending December 5, but neither the increase nor the total number of cases is large enough to indicate an epidemic.

With no epidemic and no reports so far of a more virulent type of pneumonia or influenza, the only suggested explanation for the increased death rate is lack of medical care resulting from the shortage of physicians.

ALIEN-OWNED PATENTS

MANY applications have already been received by the Office of the Alien Property Custodian at Washington for licenses to manufacture devices and materials covered by alien-owned patents, under the policy announced by the President. Something over 27,000 such patents are now tabulated; they comprise all categories as classified by the U. S. Patent Office.

Of especial interest to American manufacturers, as judged by the numbers of applications, are patents in the fields of chemistry and metallurgy. The largest single class is organic chemicals, particularly drugs. Dyestuffs are also the objects of numerous inquiries; though probably the interest here is not quite so keen as it was in World War I days, when this country found itself "caught short" by the shutting off of the German aniline products on which we had become too dependent. That situation has been remedied during the past couple of decades.

Metallurgical patents of greatest interest to American industrialists seem to be divided principally between steel and the light metals, aluminum and magnesium. Steel

makers want to try out electrical methods of smelting, and they also want to make certain types of alloy steels covered by German patents now vested in the Alien Property Custodian.

There are some applications for licenses in the field of fuels, especially gases, such as the manufacture of acetylene out of natural gas. This of course is of special importance in welding.

Among the mechanical patents available for American use under the new ruling are many on aircraft and their accessories, that were taken out by such noted German firms as Focke-Wulf and Dornier. Very recently issued, for example, is the U. S. patent on the Dornier "umbrella-tailed" dive bomber that has already been seen in action and photographed by British observers. German and Italian experimental rocket-propulsion motors for planes are also covered by patents held in custody here, which are now available for American experimentation if desired.

German physical laboratories have been the scene of great activity in the development of electron microscopes, if patents taken out in this country are a good criterion. These designs can now be taken over under license and their best features adapted to our own use, should they seem suitable for incorporation in American instruments.

THE SUPPLY OF BELLADONNA

FIELDS of belladonna, the drug called deadly nightshade, have been harvested by American farmers for the first time to replace former imports from central Europe. That yields are good and quality satisfactory is reported by the U. S. Department of Agriculture. The average content of active constituents is almost twice the U. S. Pharmacopoeia standard.

Medicines are prepared from belladonna leaves, roots, or the potent white crystals extracted from them. Physicians often prescribe them for such uses as relaxing asthmatic spasms, drying and dilating the bronchial tubes and to relieve pain. Belladonna liniment or plaster has long been used for relief of neuralgic or rheumatic pain and in the form of suppositories for painful hemorrhoids. Eye specialists use it extensively to facilitate examinations because it paralyzes the adjustment mechanism of the eye and dilates the pupil. The name, *bella donna*, itself means "beautiful lady," referring to its use by the women of old Italy to dilate the eye pupils, giving them a more alluring luster.

Although some of the drug has been grown in this country for many years, the main source has been central Europe. But in 1940 the Bureau of Plant Industry anticipated a shortage and planted the drug for seed. It has since bought seed from other sources. This was distributed last spring to growers and between 400 and 500 acres were harvested this fall in Wisconsin, Pennsylvania, Virginia, Tennessee, Ohio and other states.

The Agricultural Research Administration of the Department of Agriculture estimates that supplies are ade-



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DEHYDRATED FOODS

MANY vitamins are found in dehydrated foods if they are properly treated, was reported by Dr. Agnes Fay Morgan, head of the Home Economics Department of the University of California, to the representatives of the dehydration industry at the Western Regional Laboratory, summing up results on vitamin retention brought out by the past several years of research at the university.

Fruits dehydrated under the new factory processes retain more vitamins than those preserved by sun drying. While prunes, peaches and apricots are good sources of vitamin C, only those treated with sulfur dioxide retain this vitamin. On the other hand, the sulfur treatment destroys two thirds of the vitamin B₁, as the thiamin molecule is split by sulfur dioxide. Since peaches and apricots are not rich in B₁, sulfuring is probably desirable in their dehydration. Vitamin A is stable and is retained in both dehydrated and sun-dried fruits, but riboflavin is quickly destroyed by light so that sun-dried fruit has lost most of its vitamin B₂, while dehydrated fruit shielded from light, retains it.

In the past two or three years, Dr. Morgan and her staff have been interested in the retention of vitamins in dehydrated vegetables. Several of the dehydrated vegetables have better vitamin retention than the same ones canned. Spinach, for instance, lost 75 per cent. of its B₁ when canned, as compared to the fresh spinach, but in dehydrated spinach the B₁ was preserved almost 100 per cent.; canned peas lost 73 per cent. of B₁ as compared to a loss of 10 to 20 per cent. in the dehydrated. Concentrated tomato juice, tomato paste, and dehydrated broccoli are good sources of vitamin C.

In summing up the value of the dehydrated vegetables, Dr. Morgan stated that the vitamin C loss was from 20 per cent. for broccoli to 80 per cent. for string beans. For B₁, the loss in several vegetables ran from 14 per cent. to 33 per cent.; B₂, 25 per cent. to 50 per cent., with an exception in dehydrated carrots which had a loss of only 12 per cent. In all the vegetables tested the carotene destruction was small, while $\frac{1}{3}$ to $\frac{1}{2}$ of the nicotinic acid was lost, probably due to leaching.

Studies on meat showed that there was less loss of vitamins B₁, B₂, and nicotinic acid in dehydrated than in canned meat. The cooked dehydrated meat compared favorably with the cooked fresh meat, since there is always some loss in preparation for the table.

Vitamin assays up to three to four years ago were solely a matter of feeding animals. These take at least two months and are only reproducible within 15 to 20 per cent. Chemists have attempted to shorten the process by the use of chemical and micro-biological methods. "There is no consistency between the various tests," Dr. Morgan stated. "In each case it is necessary to check the short methods against tests on rats."

ITEMS

A REQUEST from the USSR was received by the U. S. Department of Agriculture as early as last April, for seed "to sow land plowed by German tanks." Tons of

seed are now on the way, to grow up as next year's crops. Seed shipments are the most effective kind of lend-lease aid that it is possible to send. Mere ounces of cargo weight grow into hundreds of pounds of food. Moreover, seed symbolizes the will and ability of peoples in the war-pressed lands to help themselves. In becoming a seed-growing and seed-exporting nation, the United States is reversing the pre-war set-up, when we were heavy importers of seed from Europe, especially from Denmark, the Netherlands and France.

THE lowest pneumonia and influenza death rate on record among its industrial life insurance policy holders was achieved in the last annual cycle, September, 1941, to August, 1942, the Metropolitan Life Insurance Company announces. During that period the average pneumonia-influenza death rate was equivalent to 32 deaths per 100,000 persons. This is 21 per cent. less than the previous low record made the year before and 63 per cent. less than the rate five years before. Most striking is the change in the picture during the winter months when pneumonia and influenza deaths reach their maximum. During the winter of 1936-1937, considered an average winter at that time, pneumonia and influenza deaths reached an extremely sharp peak in February with a rate of more than 175 deaths per 100,000 persons on an annual basis. At the end of February, 1942, the peak was just over 50 deaths per 100,000 persons on the annual basis. The death rate for the winter months was 70 per cent. less than in the winter of 1936-1937, and the seasonal mortality curve has flattened out so as to be "almost beyond recognition."

MOTHERS to-day are younger, but the burden of maintaining our birth rate near its present level under war conditions will fall on the women over 30 years of age, according to statisticians of the Metropolitan Life Insurance Company. In 1920, they report, women under 20 were contributing 8.6 per cent. of the total births for the year but by 1940 women of this age group contributed 11 per cent. Women of 20 to 24 years also contributed an increasing percentage of children to the nation, from 28.1 per cent. in 1920 to 31.3 per cent. in 1940. During the same two decades, women of ages 30 to 34 contributed fewer children to the nation, the percentages dropping from 19 to 17.7 per cent. The percentage of younger women in the population, however, has decreased and that of older women has increased during the same two decades. This trend will probably increase. At the same time the war has interrupted family life most for the younger women who will consequently contribute fewer children. This places the burden of maintaining the birth rate on the women of thirty years or over, which means the average size of existing families must be increased. The unfavorable effect of the war on the birth rate of the immediate future may be moderated, because most married women of 30 years or more already have children so that their husbands are for the most part still out of the classes called for military service. In addition, many thousands of these families are now in better economic position than ever to rear more children.



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SCIENCE NEWS

Science Service, Washington, D. C.

THE CARNEGIE INSTITUTION OF WASHINGTON

WAR work now absorbs the major part of the research staff and laboratory facilities of the Carnegie Institution of Washington, is disclosed in the presidential report of Dr. Vannevar Bush.

Dr. Bush has taken on wartime duties as director of the U. S. Office of Scientific Research and Development and chairman of a joint committee on new weapons and equipment in addition to his permanent position as president of the institution. His example has been followed by many members of the research staff, 34 of whom have taken leave of absence to devote full time to wartime tasks in the government, while 145 others who remain on the institution payroll are devoting all of their time to the furtherance of the 23 research projects covered by 48 contracts with the government. In addition, these war tasks have necessitated the hiring of about 150 new employees.

All the physical facilities of the institution have been placed at the disposal of the government, including practically all of the space in the administration buildings in downtown Washington. The executive work of the institution itself is now carried on in a few offices in part of the old building.

This concentration on war effort does not mean, however, that the many peacetime research programs have been altogether discontinued. Some of the work carried on requires uninterrupted series of daily observations, on such things as variations in terrestrial magnetism, and these must not be stopped because no subsequent effort could ever fill in the gaps. Other projects are so near completion, and have already involved so heavy an investment of time and money, that it seems advisable to carry them through. One group of projects, the excavation and restoration of remains of ancient Mayan and Mexican civilizations, are being continued with direct government approval because of their value in the strengthening of inter-American cultural relations.

While the great majority of war-connected researches are necessarily secret and confidential, a few examples, out of many scores discussed in the report, include:

Efforts to develop varieties of hemp for the new fiber-production program that will yield little or no marihuana to would-be drug bootleggers. An apparent correlation between double or triple chromosome numbers and high marihuana concentration has been found.

Improvement of the Russian rubber-yielding dandelion, *kok-saghyz*, by breeding methods, especially by treatment with colchicine.

Discovery that there is more than one kind of chlorophyll in plants, and hence more than one kind of photosynthesis, the basal food- and fiber-forming process. The new food-making pigments have been found in certain of the lower water-plants known as algae, which are the ultimate food of fish and which may have had something to do with the formation of the world's oil pools.

Discovery that children in such diverse racial and cultural groups as the Dutch and Navajo show "a significant trend toward increase in weight and height among the children of to-day as compared with children of the same age group ten years ago."

Finding of four more of those rarest of anatomical specimens, human embryos in their first few days of existence. None of these was more than a sixteenth of an inch in diameter.

Observation of the still-scattering fragments of an exploded star that was first observed as a nova by the pioneer astronomer Kepler in 1604.

Confirmation of the rotation of those vast island universes known as spiral nebulae. The arms of these great aggregations of stars trail as they rotate.

RARE LUMINOUS CLOUDS OF GAS ON THE SUN

Two interacting solar prominences in eruption, a rare sight on the sun, were photographed on October 3 by Dr. Edison Pettit, of the Mount Wilson Observatory, it was announced in a report published on December 19 by the Astronomical Society of the Pacific.

Solar prominences are the luminous clouds seen projecting above the edge of the sun during a total eclipse. Interactive prominences are those in which two or more are pulling material away from each other in the form of streamers. They are of great theoretical interest since such interaction indicates that both positive and negative electrical charges may exist within the same prominence.

The photographs were taken with a motion picture camera through a special device called an interference polarizing monochromator, an instrument only recently perfected for astrophysical use. Through the monochromator the sun appears as a cherry red disk of moderate brightness upon which markings can be seen totally invisible when viewed by a telescope in the ordinary way. The camera and monochromator were attached to a six-inch refracting telescope mounted in Dr. Pettit's backyard observatory. Dr. Pettit, who was among the first to discover Nova Puppis on the morning of November 10, made the first accurate photometric measurements of the nova's brightness.

When first seen upon the edge of the sun at 9:39 A.M., Pacific War Time, the object consisted of two small prominences, of which one 22,000 miles high was pouring streamers into another 9,000 miles high about 37,000 miles away. Although Dr. Pettit suspected that an eruption might be in progress, he hesitated to use the motion picture camera owing to a thickening sky and a limited supply of film. By 2:26 P.M., however, the character of the activity was no longer in doubt, the prominence then having risen to an elevation of 62,000 miles. Photography was commenced with the monochromator and continued until 4:24 P.M., when forced to halt by clouds.

The early exposures show the prominences blended into a single triangular shaped mass. This developed into a



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column which, as it rose, bent over like a whip and tended to return to a center of attraction in the near-by solar surface. Exposures made through rifts in the clouds reveal the column reaching down nearly to the sun's limb.

Measurements of the film showed the prominence first rising with a speed of 23,400 miles per hour which changed abruptly to 46,800; and then from 46,800 to 93,600. Between changes the motion was uniform, the sudden increases occurring within less than a minute.

These jumps in speed are a characteristic of the motion of eruptive prominences. Why the motion should change suddenly rather than by a gradual increase as is generally the case in nature is merely one of the many unexplained features connected with these mysterious solar appendages.—ROBERT S. RICHARDSON.

THE WHIPPLE COMET

A NEW comet has been discovered by Dr. Fred L. Whipple, of Harvard Observatory. It is a faint object far dimmer than the faintest object the unaided eye can see. Dr. Whipple discovered it on a patrol camera plate taken at Harvard's Oak Ridge station on December 7. It was located about six degrees south of Jupiter.

Once the comet was found, Dr. Whipple was able to detect it on 20 plates taken as far back as November 1, but it does not appear on photographs taken during October. The next step in the investigation will be the computation of an orbit from these positions. This will tell whether there is a chance that the comet will become brighter.

The comet was sighted by Professor G. Van Biesbroeck of Yerkes Observatory, Williams Bay, Wis., and observations made on several nights show that it is approaching the sun, and thereby coming closer to the earth. On November 17 its brightness was reported as 12th magnitude. On November 29, the brightness had increased to the 11th magnitude. The comet itself was then diffuse with a central condensation or nucleus.

On December 13 and 14 the brightness had increased to the 8th magnitude, still too faint to be seen with the unaided eye, although it can be seen with a fair-sized telescope. This new comet, discovered by Dr. Fred L. Whipple, of Harvard Observatory, has now developed a short tail with a length of 40 minutes of arc.

INFLUENZA AND MENINGITIS

INFLUENZA cases increased in two widely separated parts of the country but no signs of a nation-wide epidemic appear in the summary reported by State health officers to the U. S. Public Health Service for the week ending December 12, latest on which figures are available.

Total cases for the country were 2,604. This figure is lower than the five-year median and lower than the figure for any year since 1938. Of the total, Texas reported the largest number of cases, 732. South Carolina reported 517, Virginia 371 and Oklahoma 185. Apparently these states are having localized outbreaks.

Big influenza epidemics usually start earlier in the fall, in a year when a high number of cases the previous winter has continued through the summer. We have not had that situation this year.

Cases of meningococcus meningitis increased sharply from 88 to 103 for the week ending December 12. This is a higher figure than for the same week any year in the past five years. Meningitis cases have been running higher lately than for any year since 1937, but the total for the year to date, 3,387, is nevertheless lower than the 5,146 total for the year to date in 1937.

The death rate for large cities of the country again increased. During the week ending December 12 it was 13 per 1,000. For the previous week, excluding the mortality from the Boston night club fire, it was 12.8; the three-year average is 11.9. Since the death rate is calculated on the 1940 population figures, it may not actually be so high, because shifts in population since 1940 may have increased the number of people in many of the large cities.

THE HEALTH OF THE COMING GENERATION

RECRUITS for the Army of 1962 (if we need one then) will have sound teeth and solid bones if farmers and dairymen of 1942 put the right fertilizers on their fields and take proper care of the soil. The health and strength of the coming generation lies in to-day's fields and pastures, was pointed out by Professor W. A. Albrecht, of Cornell University, in an address at Chicago before the National Industrial Chemical Conference.

Soils are the halfway stage between rock in the mountains and silt on the bottom of the sea; mankind seized upon this geologically brief interlude in the endless cycle of erosion to extract a living from this mass of mineral particles plus humus added to it by other living things. If his use of the soil is wise, man can slow down the erosional cycle to his own advantage; if he abuses the soil it takes revenge by hastening the erosional process and leaves him hungry and faced with a stone-bare cupboard.

When soil "goes into a decline" it shows any number of warning symptoms before it is really ready to die. The speaker pointed out rising soil acidity, changes in the type of plants the soil will support, and various debilitating diseases in livestock pastured on the thinning range. A declining soil will not produce good crops of muscle- and bone-making plants; if an attempt is made to maintain total tonnage without regard to quality the new crops will have to consist more and more of "roughage" plants—bulky stuff with lots of woody tissue in it, but less and less of real food.

Professor Albrecht suggested that one agricultural college's motto: "Our national wealth lies in the soil," might well be amended by the change of one letter: "Our national health lies in the soil."

SHORT VACATIONS ADVISED FOR TEST PILOTS

TEST pilots should be given frequent short vacations with at least one week of rest in each seven weeks, to prevent chronic exhaustion, is urged by Dr. Jan H. Tillisch and Dr. Maurice N. Walsh, of Rochester, Minn., in a report to "War Medicine," published by the American

can Medical Association in cooperation with the Division of Medical Sciences of the National Research Council.

Chronic exhaustion occurs more often in test pilots than in transport pilots, a finding which it is pointed out is not surprising in view of the nature of the test pilot's work.

Most common symptoms of chronic exhaustion in the test pilot are: chronic fatigue, a feeling of inward tension and uneasiness, anxiety, difficulty in concentration, insomnia, irritability, headache, gastrointestinal disturbances and a generally increased awareness of and a preoccupation with bodily processes.

Flying, even high altitude flying, is not enough by itself to cause the chronic exhaustion. Long hours of hard work and the emotional strain of flying a new and at times hazardous airplane are the factors that bring on the exhaustion in the test pilot.

Several things can be done to prevent this chronic exhaustion state. Good physical condition should be assured by frequent medical examinations and correction of defects. At least eight hours of sleep a night should be obtained. A pilot should keep himself in good physical condition by regular exercise. More than two or three high altitude test flights in succession should be avoided.

The importance of hobbies in securing mental relaxation is emphasized. A pilot should be encouraged to cultivate some. The most satisfactory hobbies are those which are not related to one's every-day occupation and which involve making something with the hands or forming collections, so that a person can enjoy the feeling that he has created something worth having. The indiscriminate use of sedative agents by pilots in an effort to dissipate nervous tension can not be condemned too strongly. A sedative should be taken only when it is prescribed by a physician, and while under its influence a pilot should not fly. The continued use of stimulants, such as alcohol or amphetamine sulfate, is dangerous, as either one may lead to errors of judgment.

SCIENCE DEVELOPMENTS OF THE YEAR 1942

THE ten most important advances in science made known during 1942 as picked by Watson Davis, director of Science Service, are:

1. Discovery of a giant planet outside our solar system, a satellite of a star in Cygnus.
2. The brightest "new star" in 25 years, Nova Puppis.
3. Building of a 100,000,000 volt electron accelerator for x-ray production.
4. Shipbuilding, especially by assembly line methods and welding, producing largest annual tonnage.
5. Research developments that allowed production of airplanes flying much faster than 400 miles per hour.
6. The synthetic rubber program.
7. Lowest U. S. A. death rate in history and all-time record low in smallpox cases.
8. Disease fighting antibodies of the blood manufactured artificially.
9. Smaller and simpler electron microscopes to magnify 10,000 to 100,000 times.
10. Quicker treatments for syphilis, six to ten weeks clinically and one day experimentally.

ITEMS

SCIENTIFIC men who are prisoners of war in Britain will receive from their British colleagues copies of scientific journals, reprints and other reading matter that will enable them to keep their trained minds alive until peace brings them the opportunity to return to their homelands. In a fairly recent issue of *Nature*, it reports the formation of a small organization for this purpose. An appeal is issued for contributions of back issues of scientific publications; for most of the prisoners have not had a chance to see the results of British or American research that have come out since the war began, so that there is a good deal of lost time to be made up. The leader of the movement is John R. Baker, who lives in the country near Oxford. He states that the work of supplying scientific reading matter for British prisoners of war in enemy hands has been carried on for some time by the British Red Cross and the Order of St. John of Jerusalem.

NEW GUINEA'S most primitive people were shown on December 17 in motion pictures to a Washington audience by Matthew Stirling, chief of the Bureau of American Ethnology. Mr. Stirling made the films when he visited New Guinea at the head of an expedition some years ago. These people are pygmies who are still in a neolithic stage of cultural development. They have no metal tools, and until the expedition reached their country, in the jungle-covered plateau of Netherlands New Guinea, they had never seen a white man. They proved very friendly and hospitable, however, and cooperated readily, giving much information and contributing many scientific specimens.

GEOLOGISTS of the U. S. Geological Survey helped Eisenhower's men in Africa to find water, according to the annual report of the survey. Besides telling Army engineers where they would be most likely to find wells of good water, maps giving the lie of the land were furnished and information regarding mineral resources in the newly occupied territory.

PROFESSOR ALEXANDER SILVERMAN, of the University of Pittsburgh, stated in an address at the Franklin Institute, Philadelphia, on December 16 that glass is proving one of the most versatile of all war materials. It has taken over jobs formerly monopolized by such diverse materials as steel, silk and cork. It functions very much like steel in bullet-proof windshields and turrets on airplanes; glass sutures are replacing silk and gut in certain surgical uses; and a new material, bubble-filled masses of glass foam, has replaced cork in much new heat insulation. This glass foam promises to take up cork's job in life preservers also, for it is practically as light as cork and even more resistant to waterlogging. Unlike air-inflated rubber floats, it is indifferent to puncture; if a bullet passes through it, only the cells in the immediate path are destroyed, and the block floats serenely on. In addition to these more or less novel uses, glass serves the war effort in a hundred of its long-established and more conventional forms, all the way from medicine bottles and factory windows to accurately ground lenses for telescopes, range-finders and periscopes and carefully colored photographic filters.

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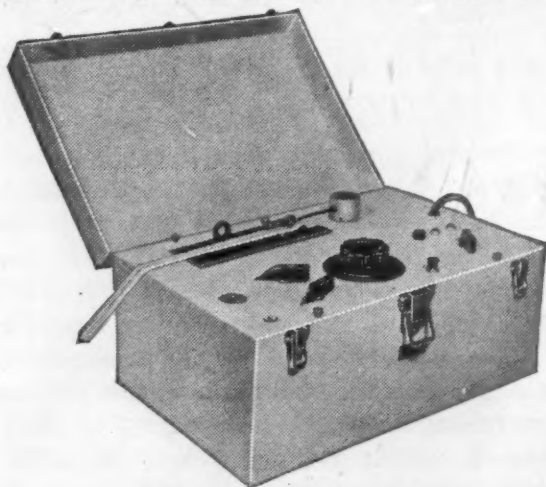
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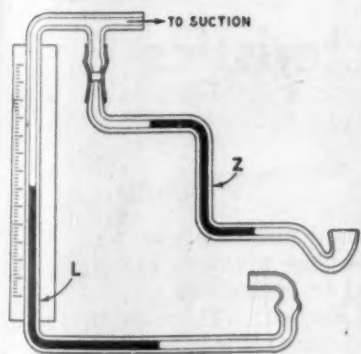
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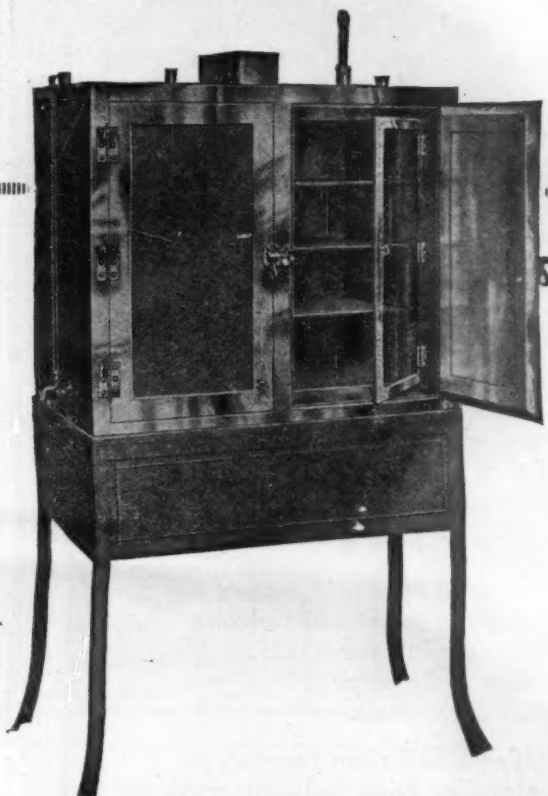
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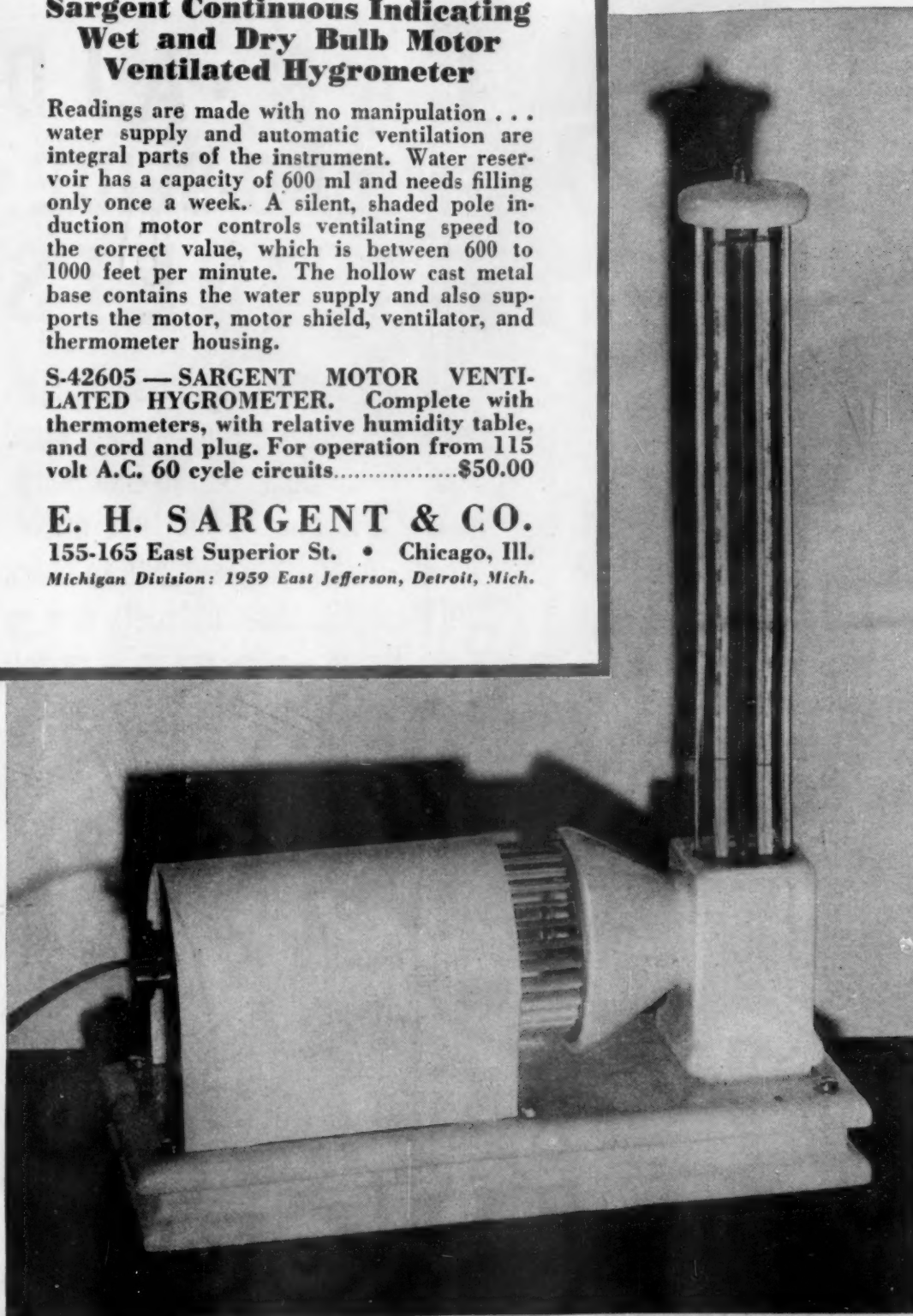
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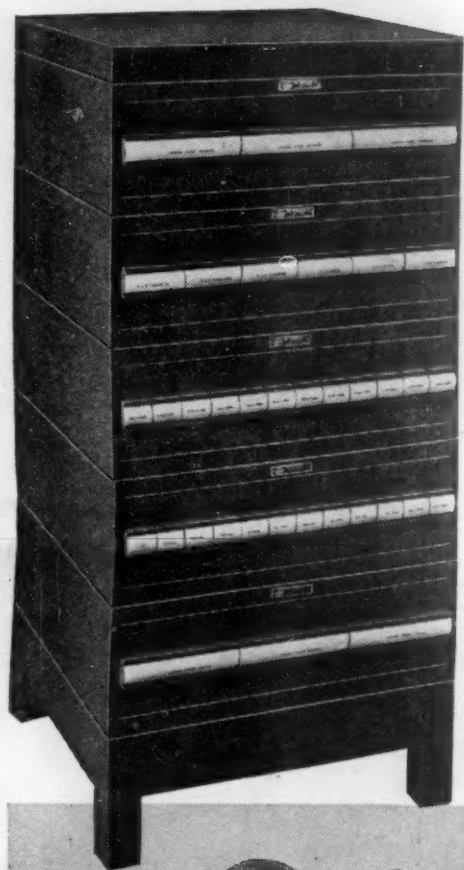
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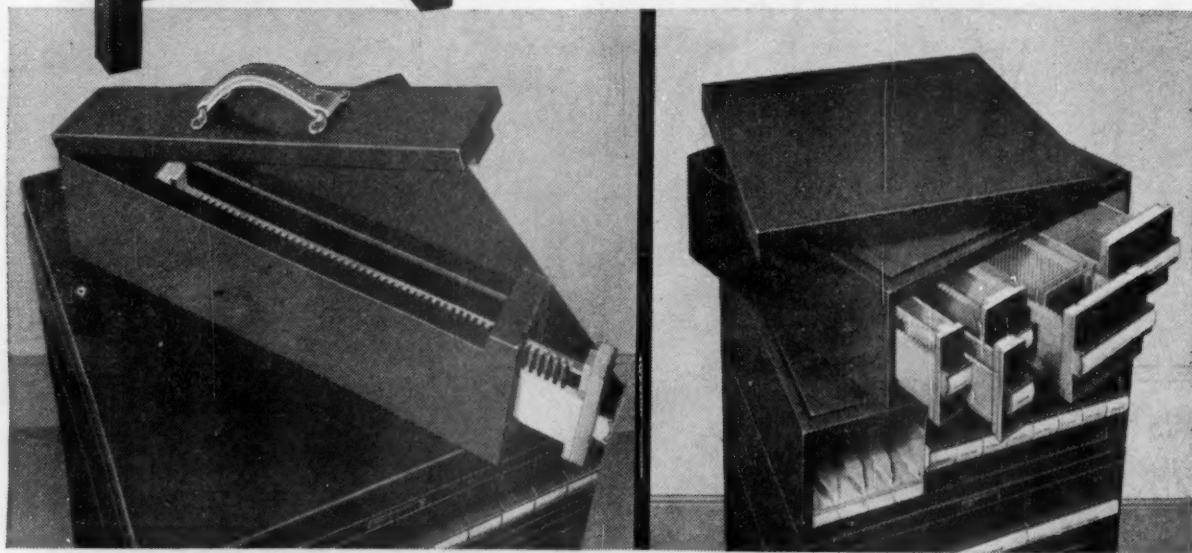
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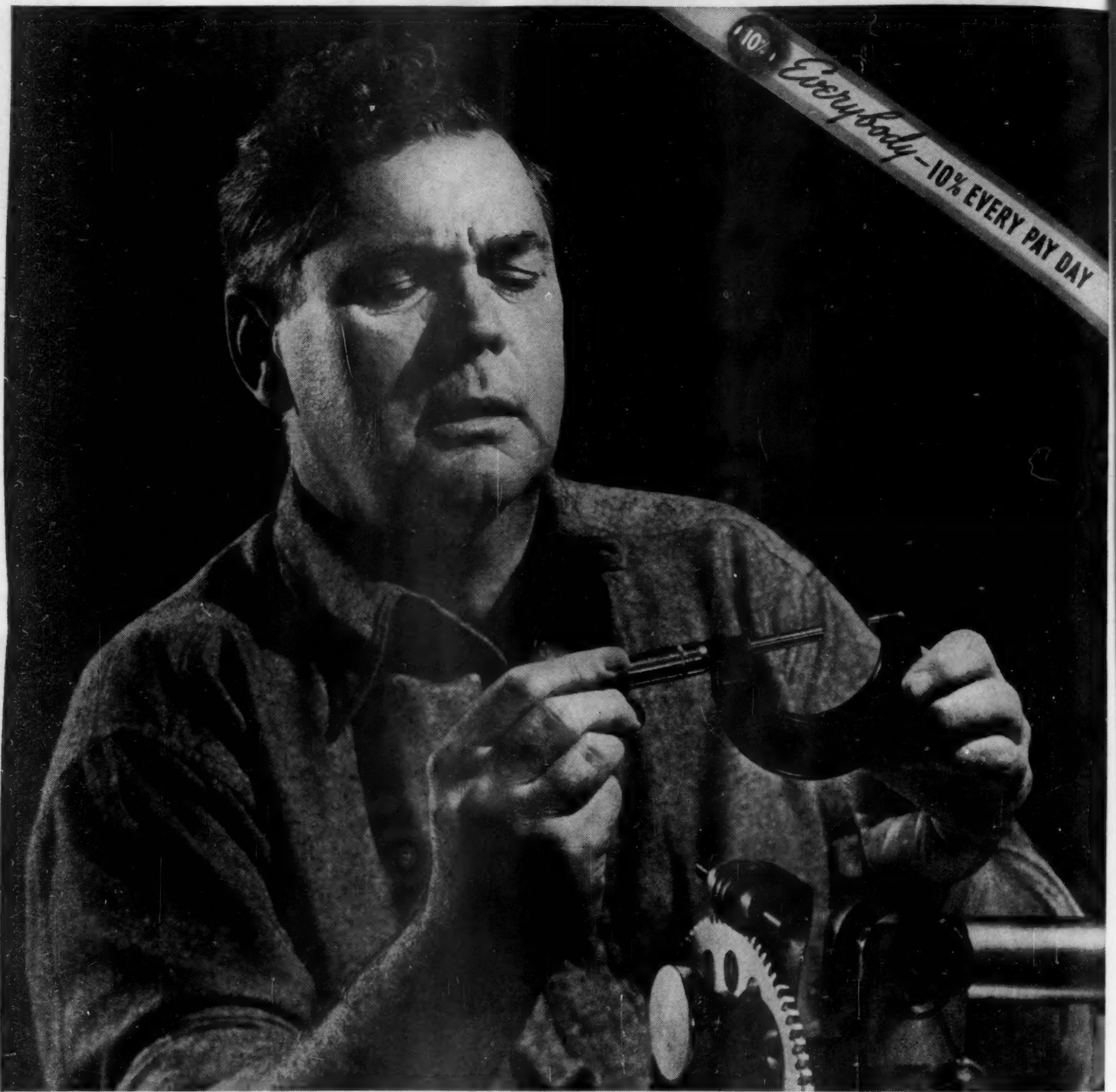
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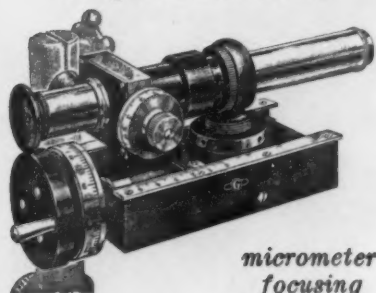
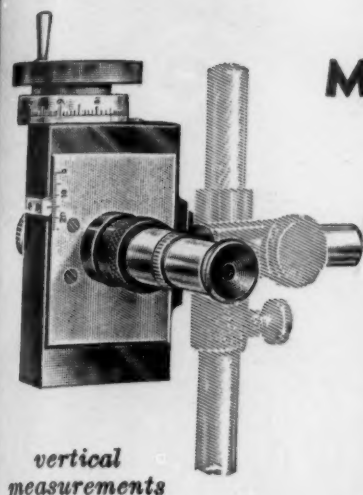
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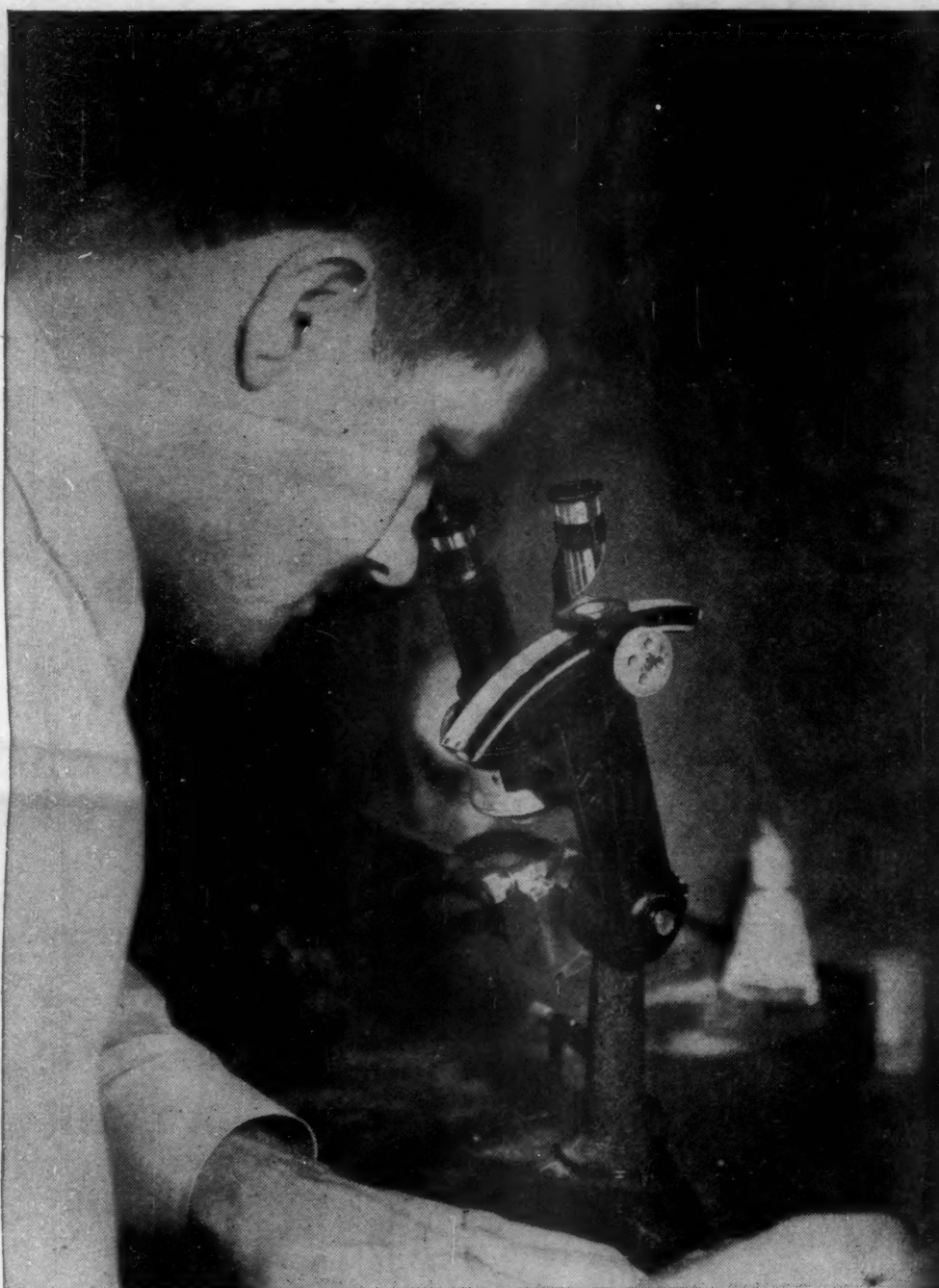
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